Adoption of interorganizational information systems

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ADOPTION OF INTERORGANIZATIONAL INFORMATION SYSTEMS:

THE ADOPTION POSITION MODEL

ADOPTION OF INTERORGANIZATIONAL INFORMATION SYSTEMS: THE ADOPTION POSITION MODEL

ADOPTIE VAN INTERORGANISATIONELE INFORMATIESYSTEMEN:
HET ADOPTIE POSITIE MODEL

Proefschrift

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THE RIDDLE

“Here is a riddle for you my friend:”

“In a room sit three great men, a king, a priest, and a rich man with his gold. Between them stands a sellsword, a little man of common birth and no great mind. Each of the great ones bids him to slay the other two. 'Do it' says the king, 'for I am your lawful ruler.' 'Do it' says the priest, 'for I command you in the names of the gods.' 'Do it' says the rich man, 'and all this gold shall be yours.' So tell me my friend - who lives and who dies?”

[…]

"Power is a curious thing, my lord. Perchance you have considered the riddle I posed you that day in the inn?"

"It has crossed my mind a time or two," Tyrion admitted. "The king, the priest, the rich man-who lives and who dies? Who will the swordsman obey? It's a riddle without an answer, or rather, too many answers. All depends on the man with the sword."

"And yet he is no one," Varys said. "He has neither crown nor gold nor favor of the gods, only a piece of pointed steel."

"That piece of steel is the power of life and death."

"Just so ... yet if it is the swordsmen who rule us in truth, why do we pretend our kings hold the power? Why should a strong man with a sword ever obey a child king like our own Joffrey, or a wine-sodden oaf like his father? "

"Because these child kings and drunken oafs can call other strong men, with other swords."

"Then these other swordsmen have the true power. Or do they? Whence came their swords? Why do they obey?" Varys smiled. "Some say knowledge is power. Some tell us that all power comes from the gods. Others say it derives from law.

[…]

Tyrion cocked his head sideways. "Did you mean to answer your damned riddle, or only to make my head ache worse?"

Varys smiled. "Here, then. Power resides where men believe it resides. No more and no less."

"So power is a mummer's trick?"

"A shadow on the wall," Varys murmured, "yet shadows can kill. And ofttimes a very small man can cast a very large shadow."

A Clash of Kings
Book Two of “A Song of Ice and Fire”
By George R. R. Martin

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Ákos

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1
Introduction

1.1 INTRODUCTION TO THE PROBLEM AREA

Supply chain integration (SCI) is gaining increasing attention both from researchers and practitioners as technological developments, increasing competition and ever more demanding customers necessitate the supply chain to be more efficient. The reduction of costs by eliminating waste and delays and the simultaneous improvement of customer satisfaction is the goal of lean supply chain performance initiatives (2001). Agile supply chains on the other hand are market sensitive and can embrace change in real demand as well in the structure of the supply network. Information enrichment, the immediate sharing of marketplace data throughout the supply chain is the key to acquire such ability in either case (Mason-Jones and Towill, 1997).

The timely dissemination of information with the use of information technology is able to diminish the bullwhip effect (Morell and Ezingeard, 2002), which is the amplification of demand order variability as orders move up the supply chain (Lee et al., 1997a). This approach requires that communication at all levels of the supply chain must be effective and timely, therefore the integration of information systems becomes a necessary component of a successful supply network design.

Interorganizational information systems (IOS), refer to computer and telecommunications infrastructure developed, operated and/or used by two or more firms for the purpose of exchanging information that support a business application or process (Li and Williams, 1999). IOS enable higher visibility between trading partners and support the struggle to lower demand uncertainty. In the context of supply chains they enable integration between trading partners through faster, more efficient and more accurate data exchange, thus offering ample benefits for companies (Bakos, 1998; Heck and Ribbers, 1999; O'Callaghan et al., 1992; Vlosky et al., 1994).

1.2 RESEARCH PROBLEM

A substantive body of research has investigated the role of information technology in the context of interorganizational relationships. It has long been argued that information technology can have profound effects on the structure and process of inter-firm relationships. This proposition has gained additional importance with the advent of the Internet and resulting increase in electronic business transactions.

Despite the benefits there are many organizations that still do not engage in cross-organizational electronic integration. In practice, the ideal scenario of supply chain-wide integration is often not realized and supply chains become fragmented (Watson,

2001). Frohlich and Westbrook (2001) found that some organizations extensively integrate either downstream or upstream, but not in both directions.

In this research we are interested in why certain IOS co-adoption projects fail or succeed. Particularly we are interested in the role of organisational power in the adoption decision. Previously behavioural factors have been treated mostly as enablers in an adoption decision. This means that the concept of power has often been operationalised as external pressure, representing the situation when one organization uses its leverage to force the dependent trading partner to adopt an IOS standard usually against that company's willingness. The introduction and the further widespread use of the external pressure construct strengthened the so-called adoption bias in the IOS literature.

The adoption bias is the view by which research work considers adoption as a desirable outcome, whereas non-adoption is seen as failure. In this thesis we try to overcome this biased view and accept both adoption and non-adoption as viable outcomes of a decision. We are doing this by developing a theoretical model where organizational power can have both an enabling and an inhibiting role.

Firms act consciously when they make a strategic or tactical decision not to adopt a certain IOS (Bouchard, 1993) therefore we assume that companies act rationally and estimate not only the benefits (Jones and Beatty, 1998; Chwelos et al., 2001), but also the perceived costs (Ekering, 2000) and perceived risks (Kumar and Dissel, 1996) of an IOS project. The successful realization of an integrated supply chain is complicated by the fact that two or more organizations are needed to agree on the adoption of the interconnecting IOS (Chan and Swatman, 1998) that necessitates the inclusion of certain behavioral, social aspects of a relationship in the study, such as organizational power and trust (Hart and Saunders, 1997; Boonstra and De Vries, 2008). The mutual adoption of an IOS by two or more organizations is called co-adoption.

The IOS adoption field already has a long history and researchers accumulated a substantive body of knowledge throughout the years. We intend to contribute to this field by the introducing the Adoption Position model. This model introduces a way to study the adoption phenomena without the aforementioned bias and with a focus on power relations and dyadic relationships. Following the classification of Damsgaard and Lyytinen (1998), our analysis focuses on the meso level, primarily concerned about the interaction of various agents within a network as opposed to macro and micro level studies that look at industry-wide effects and interfirm characteristics.

In light of this reasoning we aim to find the answer to the following research questions:

1. What determines IOS adoption and non-adoption in supply networks in a meso level of analysis?
2. How does organizational power affect the adoption of IOS in supply networks?

1.3 STRUCTURE OF THE THESIS

The rest of the thesis is divided into five chapters plus the appendix, which are organized as follows:

- Chapter 2: Research Methodology
- Chapter 3: Literature Review
- Chapter 4: Research Model
- Chapter 5: Multiple Case Studies
- Chapter 6: Discussion and Conclusion
- Appendix

1.3.1 Chapter 2: Research Methodology

The second chapter describes the methodology and research method chosen to approach the research problem. The researcher must adopt a certain mindset before setting the research method for data collection. This mindset is the philosophical approach that needs to be explicitly expressed in every study to establish the baseline definition of what reality and knowledge means for the researcher. Without a conscious choice of research philosophy the researcher is unable to define the boundaries of his research methods and the criteria those need to be assessed upon. Therefore the first sections of chapter 2 discuss alternative research philosophies and explain the particular choice we made for this study together with the consequences of that choice.

The chapter then turns to explain the research design for the study. Decisions are made and discussed about which methods suit the research questions the most under the selected paradigm and how the conceptual model was tested. The third part of the chapter describes the selected case study research method and its implications for the study. Specific design issues regarding sampling, data collection are described along with the validity, reliability measures used.

1.3.2 Chapter 3: Literature Review

Before proceeding to model development a detailed review of the related literature is given. The literature review serves several purposes: 1) to define and distinguish the IOS adoption field from other IS research; 2) to identify the context of the study; 3) to position our research within existing approaches and views that will help us relate our work to other studies; 4) not to reinvent, but rather reuse existing and validated concepts and variables where possible; 5) and to help us identify and detail the conceptual gap in the literature.

The chapter starts from a broad perspective and continuously narrows down into our specific research area. The research draws from a variety of fields, such as organization (interorganizational relationships), supply chain management, and interorganizational information systems and therefore the link to each of the relevant fields is described. The chapter also contains two meta-studies: One gives an

overview of the operationalization of the power construct in the IOS literature (section 3.4.4); the other assesses the advantages, disadvantages and inhibiting factors of various IOSs previously identified by other IOS adoption studies (section 3.3.3).

The literature review closes with our comments and thoughts about where we think the IOS adoption literature has its shortcomings (section 3.5). The whole study aims to offer an alternative approach to IOS adoption research, which overcomes these weaknesses.

1.3.3 Chapter 4: Research Model

The chapter introduces our conceptual model in detail. Section 4.1 explains our motivation for developing a new conceptual model in the IOS adoption field, which already has several accepted models. In section 4.2 we set the basic assumptions for our approach, the research context and its boundaries. Finally we position the research using existing typologies, such as the level of analysis (Damsgaard and Lyytinen, 1998) and power lenses (Jasperson et al., 2002).

Section 4.3 gives a detailed introduction and description of the Adoption Position model. This section explains the idea behind the model, introduces the conceptual model, describes the operationalization of the constructs and defines all constructs and variables. We also formulate the propositions, which are tested in the next chapter.

1.3.4 Chapter 5: Multiple Case Studies

We used case studies to gather data from 15 dyadic relationships. Chapter 5 provides the description and analysis of all case studies. Each case study features two companies faced with an IOS proposal. The data is used to evaluate their intention to adopt the proposed system and their relative dependence on each other. Intention and organizational power together forms the concept of what we call “adoption position”. The adoption position of both companies in the dyad is matched and the actual IOS adoption decision is compared to the respective proposition.

Case studies are grouped together by supply networks. Case 1-10 belong to the same supply network where one company is selected to be the reference point or focal company. Each case has a detailed description and an accompanying table that presents the data and the results. The chapter closes with a summary of the multiple case studies.

1.3.5 Chapter 6: Discussion and Conclusion

The last chapter offers a summary of the research in section 6.1. A discussion about the theoretical and practical implications of the study commences with the aim to point out the contributions of the results towards both the IOS research community and the management of companies that want to invest into IOS projects. Section 6.2 refers back to the comments of section 3.5 by explaining how our results and the conceptual model answers to those critiques. The chapter closes with the limitations of the study and with offering directions for future research.

1.4 SUMMARY

This introduction to the research study set the stage for the rest of the thesis. First, the problem area was described as interorganizational information systems and supply chain integration. Next, a brief description of the research problem followed that lead to the formulation of our research questions. The rest of the chapter gave a detailed list of the upcoming parts of the book, where we try to answer the research questions by identifying the specific gaps in the current literature, developing a new conceptual model and by testing that model with multiple case studies.

Chapter 2

Research Design

The aim of this study is to empirically examine the importance of power relations and the motivation of trading partners in the co-adoption of a certain interorganizational information system. We do this to refine existing theoretical models on IOS adoption and to further advance our collective knowledge of the adoption and diffusion of cross-organizational technologies. This chapter describes how we approached the problem introduced in the previous chapter and how the conceptual model was tested. The chapter is organized as follows:

2.1 RESEARCH PARADIGMS IN IS

Information management is a social science and as such it differs from natural sciences in that it can be approached from different philosophical viewpoints. Fundamental philosophical assumptions about the nature of reality, knowledge and human behaviour underlie any piece of research and influence the researcher's notion of acceptable research methods (Chua, 1986). Orlikowski and Baroudi (1991) discuss a range of philosophical assumptions available to study the IS phenomena, which are identified as the positivist, interpretative and critical approaches. They concluded that the positivist paradigm dominated the IS research community at the time of the study.

Chen and Hirschheim (2004) reviewed 1893 articles in order to update the findings of Orlikowski and Baroudi. They found that surprisingly, not much has changed even after years of advocacy of paradigmatic pluralism. Next to the still dominant positivist approach (81%) the only real alternative paradigm observable in any number of IS research is interpretavism (19%).

A researcher must consciously embrace a particular philosophical approach and explicitly discuss its implications to its research. This is because the assumptions about the nature of physical and social reality (ontology), together with the assumptions about what constitutes valid knowledge (epistemology), influence what are considered acceptable methods for obtaining that knowledge (methodology) (Doolin, 1996).

The major differences between the two paradigms are as follows:

Positivist: This research philosophy presupposes a reality, which exists independently of our knowledge of it. It contends that human phenomena can be studied in an analogous manner with natural science.

- *Ontology*: Positivists believe in an objectively and independently observable world, where the researcher's duty is to explain this physical and social world through universal laws and principles.

- *Epistemology*: Knowledge acquisition is achieved by the hypothetic-deductive testing of theories in a preferably controlled environment. Theories can explain social phenomena by hypothesizing causal relationships between abstract constructs and measurable variables. Scientific knowledge should allow verification and falsification and seek generalizable results. The validated models are used for prediction.
- *Methodology*: Positivists contend that research should take a value-free position and employ objective measurement to collect research data. Surveys, laboratory experiments, simulations, field experiments and case studies are all applied methods in positivist research (Galliers, 1992).

Interpretive: The interpretive approach to organizational research maintains that methods of natural science are inadequate to study social reality (Lee, 1991).

- *Ontology*: Interpretivists emphasize the subjective meaning of the reality that is constructed and reconstructed by social actors through a human and social interaction process (Chen and Hirschheim, 2004). People create and attach their own meaning to the world around them and to the behaviour that they manifest in that world.
- *Epistemology*: Scientific knowledge should be obtained by understanding of human and social interaction by which the subjective meaning of the reality is constructed and not independently of the individuals contributing to that reality (Walsham, 1995). The emphasis is on the interpretation of ongoing social interaction rather than the discovery of that reality. Interpretavists also assert that the researcher cannot be totally independent of the studied phenomena, because the research questions obtrusively effect the respondent and the researcher interprets the answers according to his own social "filter".
- *Methodology*: Understanding the meaning embedded in human and social interactions, researchers need to engage and immerse themselves into the social setting investigated. Research methods associated with interpretive research are ethnography, hermeneutics, phenomenology and case studies.

Each philosophy has its strengths and weaknesses. While through applying interpretive philosophy one can understand the dynamics associated with the adoption process in detail, interpretivism is ineffective in creating context free rules as the attached meaning of social actors to the phenomena are highly context specific. Positivist philosophy on the other hand tests relationships between two or more abstract constructs across contexts with the objective of creating universal rules, but in the pursuit of generality the insights lose contact with the individual contexts (Somasundaram and Karlsbjerg, 2003).

Kurnia and Johnston (2000) suggest that positivist factor based studies should be conducted first to understand the relationship between multiple independent variables and IOS adoption. Interpretive studies should serve as second-order models to improve the understanding of the complex bi-directional relations among independent and dependent variables and to refine the research framework. Lee (1991) proposes a research framework opposite to this, where interpretive approaches first allow an understanding of the studied context and phenomena on the subject level, then on the

observing researcher's level. As a third test, the researcher may create variables and test them to explain the social reality he or she is investigating.

The acquisition of scientific knowledge in information systems involves two distinct approaches, namely behavioural science and design science (March and Smith, 1995). The behavioural science paradigm seeks to develop and verify theories that explain or predict human or organizational behaviour. Design science on the other hand seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artefacts (Hevner et al., 2004). The latter has its roots in engineering while the former in natural science. This study intends to develop a model and thereby extending a theory that explains and predicts an organizational phenomenon surrounding the implementation and management of information systems. Therefore our research follows the design guidelines of an empirical behavioural research rather than that of the design science paradigm.

2.2 RESEARCH DESIGN

Somasundaram and Karlsbjerg (2003) advise that researchers should select a philosophy that is appropriate for achieving their objective. Our goal is to build on previous research and refine existing models of IOS adoption. The proposed changes in chapter 4 in the form of the conceptual model are substantial enough to refer back to the need to validate the model and to test the relationships anew between the variables. We take a positivist stance in our research to build and test a model consisting of variables and hypothesized relationship between them. Our logic follows the deductive reasoning of model development, data collection and hypothesis testing.

2.2.1 Literature review

Grounded theory is an inductive research approach where theories arise from generalisations of observations. Concepts and constructs emerge from observation and the methodology and theory develop gradually as the data and interpretations accumulate (Griseri, 2002). The IOS adoption field however has already accumulated a rich knowledge base since its emergence 30 years ago (Somasundaram and Rose, 2003). Therefore we decided to build on this knowledge as much as possible, because our intention is not to deviate from the main research stream, but rather to strengthen it with new insights and to refine existing models.

This is why our research cycle starts with an extensive literature review. The literature review serves several purposes in our case: 1) to define and distinguish the IOS adoption field from other IS research; 2) to identify the context of the study; 3) to position our research within existing approaches and views that will help us relate our work to other studies; 4) not to reinvent, but rather reuse existing and validated concepts and variables where possible; 5) and to help us identify a conceptual gap in the literature, which we will try to mend with our proposed research model.

2.2.2 Building the conceptual model

After having identified our research problem we commence to develop a research model. During this phase the included constructs are defined and relationships between the constructs are proposed. The operationalization stage ensures that the abstract constructs are broken down to measurable indicators. Chapter 4 provides a detailed description of the research model.

2.2.3 Choosing a research method

One of the most important building blocks of a research design is to decide on the kind of material the researcher requires and how and where to gather that material. Research strategy means the coherent body of decisions about the way in which the researcher carries out the research project. Yin (2003) suggests that choosing a research method requires a throughout understanding of the nature of the research question to be answered, as well as the characteristics of the method designed to provide the answer. Therefore it is important to consider the following three conditions that distinguish research strategies and method selection:

- Types of research questions
- The extent of control an investigator has over actual behavioural events
- The degree of focus on contemporary as opposed to historical events

Table 2-1 contains a guide on how the various research questions relate to the research methods as well as and indication of some method characteristics.

Strategy	Form of Research Question	Requires Control of Behavioural Events?	Focuses on Contemporary Events?
Experiment	how, why?	Yes	Yes
Survey	who, what, where, how many, how much?	No	Yes
Archival analysis	who, what, where, how many, how much?	No	Yes/No
History	how, why?	No	No
Case study	how, why?	No	Yes

Table 2-1: Research questions and types of research strategies
(Source: (Yin, 2003), p5)

To select the appropriate research strategy we need to examine these conditions in light of our research:

- First, the type of research question is addressed. This study examines “how” and “why” types of research questions. We intend to find out why does IOS adoption fail or succeed in supply networks and how does power affect the IOS adoption?
- We need to consider the extent of control an investigator has over the actual behavioural events. The researcher in this study had no control over the actual behaviour of the focal company and that of the trading partners.

- Finally, the degree to which the focus is on contemporary as opposed to historical events should be considered. In this study the contemporary element is high as IOS adoption was relatively new for the companies in the study. Our sample includes both ex ante observations in certain cases and ex post reflection on the adoption decision.

Having considered the above criteria we can summarize that this study asks "how" and "why" questions about contemporary events, over which the investigator has little or no control. According to Yin (2003) under such conditions the case study method is the appropriate research method for data collection.

2.2.4 Case study research method

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2003). Case studies typically combine data collection methods such as archives inspection, interviews, questionnaires and observations. The evidence may be qualitative (e.g. words, descriptions), quantitative (e.g. numbers) or both (Eisenhardt, 1989). This method can be used to accomplish various goals: to provide description, test a theory or generate a theory.

Compared to other research methods, the potential strength of case studies include capturing reality in greater detail, with the ability to analyze many variables, thus providing a richness of information about the situation or organization (Galliers, 1992). An experiment, for instance, deliberately separates the observed variables from their context by controlling all extraneous effects. Although surveys try to deal with both the observed phenomenon and the context, their ability is somewhat limited. The number of questions in a survey has to be minimized in order to get a satisfying response rate, therefore the number of variables that can be measured can be overly limiting for context dependent phenomena.

Our study investigates the co-adoption of interorganizational systems in a dyadic setting. The unit of analysis requires the measurement of variables from at least two different actors. Survey design alone would be somewhat limiting in this setting, because 1) when sending the questionnaire to a random sample of companies, we could only measure single-firm variables and 2) measuring relation specific variables would be very hard without the introduction of various bias in the study (self-selection of trading partner). In other words we would have less control about which trading relationship did the respondent select and the reason behind that choice. Respondents would likely choose strategic partners with whom they enjoy a fruitful relationship over a longer period of time, instead of a less successful or short-term relation. This could potentially compromise our aim to collect both successful IOS adoption and non-adoption cases. The introduction of a survey within a case study design circumvent the above mentioned two problems as it is explained in section 2.2.5.2.

Experiments in form of business games or simulations are used sometimes in IS research. Although it would allow us to have ample control over situational and contextual variables, it is unlikely that the findings could be generalized to real-life decisions. Scenarios played out by students or professional practitioners could act as an alternative to case studies, but they would not be able to provide as rich data on real managerial decisions, because the context is artificially created. Our focus is on power relations between dyadic partners and power structures throughout a supply

network, which are very sensitive issues. Artificially created contexts would be unable to reflect the real pressures and relational subtleties that dependencies create between trading partners. These concepts are best observed in a real business setting where the sources of power and the extent of dependencies can be assessed using various sources of evidence.

Case study as a research strategy comprises an all-encompassing method: covering the logic of design, data collection techniques and specific approaches to data analysis.

2.2.5 Case study design

This study uses multiple case studies as it was considered to be an appropriate method to test the propositions. The purpose of multiple case study designs can be twofold: first it can serve as a replication of the findings with as much similarity to the first case as possible with the aim to find out whether the results can be duplicated. These replications with slight alterations confirm the findings and deem them more robust. A second reason for choosing multiple case studies is to allow theoretical replication. Under theoretical replication, cases must be selected so that they predict contrasting results, but for predictable reasons (Yin, 2003)

2.2.5.1 Sampling

Our propositions try to explain and predict the adoption decision outcome for an IOS by two trading partners by combining the motivation of each firm and their structural contingencies. The combinations result in mutually exclusive categories that we call adoption position pairs. Chapter 4 describes the logic of adoption positions in detail. For data collection purposes we need to use theoretical replication of cases in order to find compelling evidence for the existence of the various relational types proposed by the conceptual model and for their predicted adoption outcome. Each adoption position pair can be treated as one case.

In order to study dyadic relationships and to limit the number of extraneous variations we select a focal company and collect data from one this company's population of suppliers and customers therefore always fixing one side of the dyad. Subramani (2004) has already used this method successfully. Features of the technology, the IOS requirements, intention of the focal company are fixed variables that allow a more precise interpretation of the varying factors. Generalizability of the results is a weakness of this approach, because the results might only reflect the situation in the studied network or industry. Repeating the study in several different industries could overcome this problem and reveal to what extent is the model generalizable. The organizations consisted of both large- and small-medium enterprises. The main criteria to select the focal companies were the following:

- *Geographical proximity*: Limitations due to research budget prevented the selection of a focal company outside of the Netherlands.
- *Supply chain member*: The company should be a member of a manufacturing or service oriented supply network.

- *IOS history or plan to implement within 1 year*: The focal company should have already adopted IOS with trading partners or is planning to adopt a system within 1 year. Ex post adoption cases have the advantage of providing a closed case, where both parties have already made the adoption decision. It is also possible to dig in into company history and uncover failed adoption proposals, which are potentially interesting cases in terms of the reasons of non-adoption. A disadvantage of ex post analysis is that the respondents might have difficulties answering how had they perceived the benefits, costs and risks before they made the decision.

  Ex ante cases carry the risk of being prolonged and not finishing within the time of the research frame, however they provide much more accurate values on the management's perception of system benefits, costs and risks as well as on the actual dependence between the two companies.

2.2.5.2 Data collection procedures

Data collection is the logic of linking the data and the propositions. Yin (2003) identifies six sources of case study evidence: documentation, archival records, interviews, direct observation, participant observation and physical artefacts. We followed three suggested data collection principles: multiple sources, maintaining a chain of evidence and creating a case study database.

Information about organizational, product and background was gathered through document analysis and later during the interview sessions. A brief description and purpose of the study was sent to the selected companies via an email or letter, which asked for participation in the research. Once the company has shown interest in participating in the study a discussion over the telephone set the initial meeting with the appropriate person. Respondents ranged from purchasing managers, IT managers, EDI coordinators, regional directors and customer service team coordinators.

After the collection of data about current IT architecture, market, product range of the focal company, interviews with supply chain managers and with the customer relation team leader provided information on the immediate tiers in their supply network. These interviews were guided by a case study protocol. The interviews were conducted over two-hour sessions. The interview sessions were recorded and transcribed. Later the participants verified and confirmed their responses through a draft report.

A structured questionnaire was developed based on a review of previous studies. The instrument was refined with the help of an expert and with pre-tests during the interviews at the focal companies. The questionnaire had four different versions, one for a buyer and one aimed for a supplier in a dyadic relationship, because the measures of dependence and the wording of some question items differ between these two. The other distinctive factor between the surveys was whether it was an ex post or ex ante IOS adoption case. The appropriate questionnaires were sent out to select trading partners on both the supplier and customer side.

The structured questionnaire included the following themes:

- Background information about the company, control variables
- Current level of IT maturity, existing type of IOS and internal information systems
- Perceived benefits of a particular IOS
- Perceived switching costs to a particular IOS
- Perceived risks of a particular IOS with a specific trading partner
- Dependence and sources of power in the dyadic relationship
- Intention to adopt or extent of use

The questionnaire was not only a data-gathering tool, but also helped us screen out interesting cases. Representative cases were selected and the dyad was established as a case. At this point the purchasing manager (or customer relationship manager) was asked to evaluate the relation specific parts of the questionnaire separately for each selected dyad. We also asked for a meeting with trading partners, which were geographically close, in order to triangulate the survey results by interviewing IT and purchasing managers. These field surveys proved to be very useful in providing qualitative data in addition to their respective survey data, which helped explaining some of their views and perceptions about the IOS and the trading relationship in greater detail. Phone interviews were conducted with those trading partners who resided outside the Netherlands.

2.2.5.3 Research quality

This section discusses how the case study design ensures reliability and validity of the findings. The validity of a case study research relies heavily on the sampling criteria, research process, the method of analysis and the interpretation of the collected data (Yin, 2003). The quality of data collection in case study research can be maintained by complying with the criteria listed in Table 2-2.

Criteria	**Approaches to achieving the criteria**	**Phase of Empirical Research**
Construct Validity	Use of multiple sources of evidence Establish chain of evidence Have key informants review draft case study report	Data Collection Data Collection Data Collection
Internal Validity	Do pattern matching Do explanation building Address rival explanations Use logic models	Data Analysis Data Analysis Data Analysis Data Analysis
External Validity	Perform multiple case studies with replication logic	Research Design
Reliability	Developing case study database Use case study protocol	Data Collection Data Collection

Table 2-2: Design tests for case studies (Yin, 2003)

Construct validity aims to establish correct operational measures for the concepts being studied. Since we can only know as much about the concept as much we can measure with our constructs, this test is extremely important. In empirical case study research we can ensure the validity of constructs by using *multiple source of evidence* and see whether these multiple sources give us the same answers.

The use of multiple sources of evidence was seen as a major strength in the case study method. Document analysis included trading partner agreements, IOS proposals, email exchanges, order forms, websites, product catalogues. The semi-structured interviews resulted in recorded audiotapes, annotated transcribes, written notes by the interviewer, graphical explanations of processes by the respondents, narrative descriptions and qualitative information through informal discussions. This procedure allows data triangulation as the different sources corroborate information about the same phenomenon.

The *chain of evidence* principle recommends that a case study is designed and reported in a detailed fashion so that the reader or an external observer can trace back from the conclusion to the initial research questions. This concern was addressed by creating a detailed narrative case study that explains the causal experiences of the respondents.

An additional test for construct validity was carried out after each interview session. The participants received a draft report about the interview and *later key informants received a draft* of the case study report. This notion served two purposes: 1) the participants can corroborate that the researcher reported the essential facts and evidence right; 2) the researcher does not release sensitive information about the company or when he does so, the respondents and the company are to remain anonymous. This procedure enhances the accuracy of the report.

Internal validity is about the control of causality. Strong internal validity refers to the unambiguous assignment of causes to effects. This test gives a justification whether the independent variables are causally linked to the dependent ones. A strong internal validity does not only mean that the hypothesized causal relationship holds between the variables, but also that the absence of a relationship implies the absence of a cause. In case studies, the test of internal validity is only applicable in explanatory case studies, because exploratory and strictly descriptive ones do not make claims about causality.

Case study researchers have much less control over exogenous variables that can potentially confound the results than experimenters in a laboratory. Nevertheless there are ways to ensure strong internal validity. *Pattern matching* logic compares an empirically based pattern with a predicted one (Yin, 2003). Our model essentially creates patterns of paired intentions and dependence structures and predicts the outcome of these patterns with a theoretical explanation. By observing multiple cases we identify the various predicted patterns and match them with the actual outcome. We provide theoretically significant explanations for the differences between the outcomes (adoption vs. non-adoption) for each pattern.

To ensure that the proposed relationships really hold we examine *rival explanations*. Our goal is to see whether variables outside of the conceptual model lead to IOS adoption or its non-adoption. We define the boundaries and the context of the research in chapter 3 to have some of these rival explanations explicitly excluded. Alternative

explanations were continuously considered throughout the interviews. We collected extensive narrative material from respondents to *build up explanations* for the relationships between the variables and to rule out rival explanations. Several different questions were used during the interviews and in the survey to ensure that the respondent is consistent with his/her answers about the phenomena.

External validity deals with the problem of the generalizing the findings to other people and other situations. It measures the extent to which the research finding is applicable to the population of cases outside of the sample. Researchers have to avoid overfitting their model to the observed cases, otherwise their model cannot be used outside the sample. Single case studies offer poor basis for *generalizability*. In surveys, a random sampling from a well-defined population yields a strong external validity. Survey research relies on statistical generalization, whereas case studies rely on analytical generalization (Yin, 2003). In analytical generalization the researcher is striving to generalize a particular set of results to some broader theory.

A theory must be tested by replicating the findings within the population, where the theory has specified that the same results should occur. In this study we use multiple case studies using theoretical sampling to find support for the theory. First, multiple dyadic relationships are examined within one supply network. To increase the external validity of the findings we replicate the study in different industries.

Reliability of the measures is required to make statements about validity. The goal of reliability is to minimize the errors and biases in a study. A case study is considered reliable when another researcher would arrive to the same results using the same research method and measures. Therefore the research procedure must be well documented by making as many steps as operational as possible. The researcher must break down the research procedure to small steps so that it can be traced back and reapplied by other investigators. The explicit explanation of each step increases the reliability of the results, because the researcher shows that he or she conducted the study in a standardized way.

The multiple case studies were conducted in a real world setting and therefore it is highly unlikely that the exact same situation will reoccur. To ensure reliability we used the following techniques. The cases followed a *case study protocol* (see Appendix B) that lists a set of standard steps to be taken for each case study. The structured questionnaire formed a basis for the interview protocol, which is in addition contained a list of open-ended questions to guide the interview.

The case study data were collected and maintained in a *case study database* that includes transcribes, interview notes, drawings, case study- and interview protocols, recorded audio material, tabular data of surveys and copies of documents (purchase order forms, product catalogs, IOS messaging standards, emails, IOS proposals).

2.3 SUMMARY

This study develops a conceptual model based on previous literature and in fact can be considered as theory expansion. Propositions about IOS co-adoption are made and they were tested using multiple case studies with a positivist approach. Based on Yin's arguments, this study uses analytic generalization rather than statistical generalization. Replication logic is used in the sampling of the various case studies to

find compelling evidence for the existence of the various relational types proposed by the conceptual model.

To ensure high research quality we used various techniques to strengthen the validity and reliability of the findings. We used the principles of multiples sources of evidence, chain of evidence, draft report review by respondents to ensure construct validity. Internal validity was addressed by using pattern matching, explanation building techniques while examining possible alternative explanations. To be able to generalize the findings we used multiple case studies, which were selected through theoretical sampling. The research was structured by a case study protocol that contains the procedures for conducting the research and the interview protocol, which guided our interviews. The data is organized and stored in a case study database for later retrieval. These measures help us present reliable findings.

Chapter 3
Literature Review

Unlike the use of grounded theory approach we acknowledge the findings of previous studies and we utilize existing research to "stand on others' shoulders". Webster and Watson (2002) suggest that literature reviews are important, because they offer the opportunity to synthesize and reflect on previous theoretical work, thus providing secure grounding for the advancement of knowledge. In this chapter we are going to provide a detailed review of the related research fields: interorganizational relationships (organization), supply chain management, interorganizational information systems and the power perspective. The link between these research fields and the current study are explained during the review. The chapter closes with our reflections on the review, where a few weaknesses and shortcomings of the existing IOS research are revealed.

3.1 INTERORGANIZATIONAL RELATIONSHIPS

The chapter starts from a broad perspective and continuously narrows down into our specific research area. In order to understand the adoption of interorganizational information systems we need to place it in a context. From the most general perspective the setting where this phenomenon takes place is an interorganizational relationship (IOR). Interorganizational relationships as opposed to intra-organizationals refer to the interactions between independent organizations. The interorganizational level of analysis has become attractive to organizational scholars in the past decades as the pure form of market and hierarchy appear to have limited explanatory power (Bensaou and Venkatraman, 1995).

3.1.1 Types of Interorganizational Relationships

IORs can differ from each other to a large extent, therefore it is necessary to identify categories of relationships or typologies that will help focus our research. The vast amount of past literature on the various aspects of interorganizational interaction helps to characterize IORs and allows us to categorize them by the number of participants, the strength of the tie between the organizations, the goal of the relationship and the form they take.

A relationship between two interacting and mutually influencing organizations is called a dyadic relationship. Dyads are the basic units of interorganizational research, because they are the smallest possible units of analysis. Dyads are usually represented graphically by two nodes being interconnected with a line. Replacing the line with an arrow is a common way to indicate the flow of goods, money, information or other

object of the interaction from one part of the dyad to the other, while a double-sided arrow refers to the reciprocity of the relationship. The multiplicity of interconnected dyadic relationships is called a business network. The smallest business network consists of three organizations that form two connected dyads, where one organization participates in both dyadic relationships, acting as a bridge. This type is referred to as "chain". A configuration where the three participants are all connected with each other through three dyadic relationship is often called a "network".

To be more specific about IORs we restrict our discussion to relationships between private firms and exclude non-profit organizations and the public sector. This restriction is important, because the goals, interests and resources of a privately held company are different from that of the government or a university. Firms engage in these relationships to create value by combining resources, sharing knowledge, increase speed to market and to gain access to foreign markets (Doz and Hamel, 1998). There are various forms that an IOR can take to realize these goals. A joint venture is created when two ore more firms pool a portion of their resources to create a separate jointly owned organization (Inkpen and Crossan, 1995). It is a device to obtain access to resources, which are embedded in other organizations (Hennart and Reddy, 1997). Consortia are a special form of joint ventures, a group of organisations who come together to fulfil a combined objective or project that usually requires co-operation and the sharing of resources. Barringer and Harrison (2000) distinguish IOR forms by the degree to which participants are linked, or coupled together. Joint ventures and consortia are tightly coupled forms of organizing where the participants are linked together by formal structures and which often involves joint ownership.

Loosely coupled configurations (as the term used by Barringer and Harrison) on the other hand have less hierarchical control and involve no joint ownership. The terms should not be confused with loosely and tightly coupled *systems* where the term coupling refers to the extent to which two systems are directly related to each other and not to ownership structures. Alliances, for example, are agreements between two or more firms to achieve a common goal or to establish an exchange relationship. While bilateral (dyadic) strategic alliances tend to involve agreements that have a narrow focus, a collection of several alliances, so called constellations define a broad, more general goal (Das and Teng, 2002), often elevating competition from individual firm level to a competition between alliance blocks (Vanhaverbeke and Noorderhaven, 2001). A trade association is also a loosely coupled form of IORs, which is formed by firms in the same industry to collect and disseminate trade information, offer legal and technical advice and provide a platform for collective lobbying (Barringer and Harrison, 2000).

These types of interorganizational relationships are very interesting from a governance or an organizational point of view, but create much diversity in terms of information needs, information processing and communication. We are further restricting our research to trading relationships where buyers and suppliers share a set of practices and routines that support economic exchanges between the two firms (Kotabe et al., 2003). Although the above listed IOR forms are not covered in the current research, they needed to be mentioned and explicitly excluded in order to avoid ambiguity regarding the context of the study.

We can also find different configurations of IOR forms within trading relationships. Bensaou and Venkatraman (1995) identify five different ways of how suppliers and buyers can interact in the long run effectively. Their study applies the information processing view (Galbraith and Schendel, 1983) to an interorganizational level and posits that the information processing needs of such a structure should be matched to the information processing capabilities of the IOR. This means that the information processing needs of a company depend on the uncertainty it is faced with (environmental-, partnership- and task uncertainty) and that this need should be matched by the appropriate structure, process and information technology to satisfy that need. By studying the US and Japanese automotive industry with an inductive approach they uncover the following IOR configurations: Remote relationship, Electronic control, Electronic interdependence, Structural relationship and Mutual adjustment.

3.1.2 Strength of IORs

Another way to describe interorganizational relationships is by looking at the strength of the network tie in dyads. The analysis of the effect of tie strength, in terms of weak ties or strong ties, originates from social network theory (Granovetter, 1973). Its importance lies in such strategic concerns as which companies to collaborate with, what sort of ties to build, how close a partner should be? Tie strength has been defined in various ways in the literature: loosely- or tightly coupled relationship ties based on joint ownership as used by Barringer and Harrison (2000), long- or short term relationships based on the time span of the contracts, arms's length or collaborative way of working based on the management style of the IOR (Cox, 2004a). Measures can range from a single variable to multidimensional constructs: most studies use a rather straightforward binary, categorical measurement, while some incorporate several indicators, such as the amount of time invested in the relationship, intensity of network ties, organizational interaction and reciprocity, similarity, structural equivalence and cultural closeness (Hagedoorn and Cloodt, 2005).

Various studies have shown that the strength of interorganizational relationship has an effect on the diffusion of technology and knowledge. However, findings are mixed. One part of the contributions argue that in order to achieve joint learning and knowledge transfer between trading partners, trust and familiarity with each other and effective communication is needed (Kale et al., 2000; Womack et al., 1990). The evolution of such properties in an IOR is a function of time invested in the relationship and commitment from the parties involved. This means that a strong tie will contribute to joint innovative efforts and technology adoption will be more likely.

On the other hand, following the argument of Granovetter (1973; 1983), weak inter-firm ties are able to generate more relevant new information. Dissimilar firms offering different perspectives and those weak ties that connect internally strong and cohesive networks of firms could provide a structural bridge and enable the diffusion of new technological alternatives.

The question arises: should we form strong or weak ties then? Rather than being normative and to pursue the one "best" IOR configuration, we prefer to think along the lines of Bensaou and Venkatraman (1995) whose research indicate that there are multiple ways to develop effective inter-firm relationships. Trading relations tend to form both strong and weak ties and there are communication technologies that can get adopted regardless of tie strength. Therefore we will rather focus on the appropriateness of relationship management styles (Cox, 1997; Cox et al., 2004) given the circumstances of the trading partners in developing our model in chapter 4.

3.1.3 Theories of IOR

Organizations can start to form a relationship with each other for numerous reasons. Researchers have been trying to understand the reasons behind the existence of organizations and the reasons why they start interacting with each other. Among the dozens of theories that have emerged in the past decades a few have become more influential than the others. As more scientists turned to refine these ideas, the theories got more detailed and better defined. Transaction cost theory, the resource-based view and theory on competitive strategy are proved to be particularly relevant economic theories to our current study as they form the foundations of the ideas and assumption used during the research.

Transaction cost theory (TCT) (Williamson, 1975) provides an explanation on the make-or-buy decision of firms, in other words, how much of a given product or service should a firm outsource and how much it should produce/provide in-house? TCT calculates the total cost of both outsourcing and insourcing for any given transaction and the option with the lower cost is chosen. Total cost equals production cost plus transaction costs. Transaction cost is further broken down into coordination cost, operations risk an opportunism risk (Clemons et al., 1993). Coordination cost here covers the costs of exchanging information about the product with production units (schedules, demand, design) and incorporating that information into decision processes. Operations risk is the risk that the other parties in the transaction wilfully misrepresent information or underperform. Opportunism risk is the risk of opportunistic behaviour from other parties in the transaction. TCT considers markets (outsourcing) and hierarchies (internalizing) as the two possible governance forms under which transactions can take place. The trade offs are larger production-, but lower transaction cost under hierarchies and lower production-, but higher transaction cost in markets. Information systems used in an IOR are able to reduce transaction costs, therefore our study on interorganizational information systems can borrow the concepts of TCT in determining the behaviour of organizations in a dyadic relationship.

The *resource-based view* (RBV) offers a perspective where a firm is viewed as a collection of resources and capabilities (Barney, 1991). To create value and gain competitive advantage, firms are striving to combine resources internally and to acquire additional resources from external sources. Competitive advantage can only be sustained in the long run when the combination of resources results in a capability, which is valuable, scarce, durable and non-imitable. Resources controlled by the firm that have a high utility for other organizations and are relatively scarce on the market are called critical assets (Cox et al., 2002). These critical assets form a source of power for the focal company over trading partners. We utilize the resource-based view in creating our measures for dependency between companies.

In addition, Porter's seminal work on *competitive strategy* (Porter, 1985) has a great impact on this study. Porter emphasized the importance of external forces affecting the firm and its competitive position. According to him five forces shape the strategic decisions of a firm: 1) the bargaining power of its customers 2) and suppliers; 3) the barriers of entry for new competitors; 4) threat of substitute products/services; 5) the level of competition in the industry. The size of the customer/supplier pool in the value network, the cost of switching from one trading partner to the other and lock-in effects created by certain dependencies and critical resources are all factors that can have a profound effect on the extent of information exchange and the development of information systems between organizations. Therefore we take the implications of competitive strategy into account during the formulation of our research model and during the analysis of cases.

3.2 SUPPLY CHAIN MANAGEMENT

3.2.1 Definitions and topology of the research field

So far we have defined the context of our research as interorganizational trading relationships between private companies and have described several characteristics of IORs. We decided to draw from the rich literature of supply chain management as the interest of this research field corresponds to our problem area.

In the beginning of the discussion it is important to find a plausible definition for the chosen field of interest. Supply chain management (SCM) is continuing to remain a topic of interest both for researchers and practitioners as technological developments, increasing competition and ever more demanding customers necessitate the supply chain to be more efficient. Waste and delays can be reduced through increased coordinated operations and collaboration in planning. Fast and reliable information sharing about planning, scheduling and inventory levels, the elimination of paper-based administration and other practices have become a key component in the relationship. But what do we mean exactly under supply chain management?

The number of articles written in this field has dramatically increased since the mid-90s and there are several similarities and dissimilarities between the definitions of SCM used in the literature. Most often the distinction between purchasing and supply chain management is blurred. Larson and Halldorson (2002) surveyed purchasing managers and they conducted a meta-analysis on past literature to determine which topics are regarded as being included in SCM and which are not. They list four conceptual perspectives on purchasing versus SCM (traditionalist, relabeling, unionist

and intersectionist). Kauffman (2002) proposes a unifying framework of the strategic components in supply and *related fields*. Surprisingly, on a side note, this framework does not include any reference to the field of information management.

Giunipero and Brand (1996) provide three typologies on how articles regard SCM: flow of goods approach, flow of goods and information approach, and integrative value added approach. We can use this typology to understand how the view on SCM has evolved. Articles that follow the flow of goods approach typically consider SCM as the purchasing function of the firm (Goh et al., 1999; Kanji and Wong, 1999; Giunipero and Pearcy, 2000). Kanet and Cannon (2000) take it one step further as they define SCM as a new logistics management approach resulting from the redesign of logistics management systems, which aims to maximize the efficiency and effectiveness of the chain that runs from raw material supplier to final consumer.

Other studies give a broader definition: Christopher (1992) defines a supply chain as the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer. Larson and Rogers (1998) give as many as 10 different definitions. From the reviewed literature we can conclude that the more integrative and strategic the approach toward supply chain management, the broader its definition became and the less it is regarded simply as the purchasing function of the firm.

In this study we are going to use the definition of Cox et al. (2001) on supply chains (SC):

> *"An extended network of dyadic exchange relationships that must exist for the creation of any product or service that is supplied to a final customer."*

Supply chain management is then:

"…the coordination of activities within and between vertically linked firms for the purpose of serving end customers at a profit."

after the definition of Larson and Rogers (1998).

Supply chain management has been examined from different perspectives, encompassing a multidimensional field of research. The performance of an organization is widely agreed in contemporary management and organization literature to be influenced by the actions of organizations that make up the network or supply chain it operates in (Croom et al., 2000). The notion of strategic networks has become more popular with Porter's (1985) seminal work on the value systems and the external powers that affect an organization. The field has evolved largely through an increasing trend toward the externalization of performance measurement from the field of operations management (Harland, 1996). SCM research has branched out from its core concerns around logistics/operations processes through the incorporation of theoretical concepts from strategic management, industrial organization, institutional economics (transaction costs), interorganizational relationships, information systems, knowledge management and systems theory.

SCM is thus a field of research that cuts across many disciples. In order to keep the field more coherent, Giannakis and Croom (2004) developed a conceptual framework that identifies the main themes of SCM. The themes or strategic dimensions identified

by the authors are synthesis, synergy and synchronization. We describe these themes briefly to summarize how the various disciples relate to SCM.

- **Synthesis**: Structural aspects of supply chain where the key problems are decisions relating to strategic position of the firm, the extent and scope of vertical integration, supply base configuration and the structure and choice of channels to customers. Relating fields are industrial organization, institutional economics and network theory.
- **Synergy**: Interaction and relations within the supply chain with a focus on supplier selection, customer relationship management (CRM) and interorganizational behaviour. This dimension relies heavily on IOR and strategic management literature.
- **Synchronization**: Process oriented dimension where typical concerns involve decisions on scheduling, coordination, information management and material flow analyses. This is the domain of operations management, logistics and operational research.

The term "chain" is rather misleading as it brings to mind a sequential chain of events whereas SCM mostly deals with a network of trading partners. Some articles prefer to use the term supply network instead of supply chain to avoid this reference to linearity. Giannakis and Croom (2004) make an explicit distinction between these terms and consider them to be on a different level of analysis. Lamming et al. (2000) interpret the supply network as a concept that describes lateral links, reverse loops, two-way exchanges, encompassing the upstream and downstream activity, with a focal firm as the point of reference. Supply networks are then the broadest definition of interconnected dyadic trading relationships, which are needed to produce and deliver a good or service to final customers while supply chains are specific "paths" within such a network.

We also need to make a distinction between manufacturing and pure service oriented SCs. Pure service supply chains (e.g. insurance, consultancy) take information as raw material, add value to it with their experience and create know-how (intuitive or codified) (Cox et al., 2001). Without the absolute presence and movement of physical goods, the SCM practices needed in service-oriented SCs are quite different for that of other supply chains.

3.2.2 Supply chain integration

Achieving efficient and effective coordination among the various activities within companies is in itself a challenge for management. Coordination is particularly problematic when considering supply networks, because the scope of business processes exceeds the individual company's boundaries (Danese et al., 2004). Malone (1987) defines coordination as the pattern of decision making and communication among a set of actors who perform tasks to achieve goals. In supply networks managers face three different forms of structural complexity that makes the two aspects of coordination (decision making and communication) harder to execute. Vertical complexity refers to the number of tiers in the whole system; horizontal complexity refers to the number of organizations on the same tier of a network; and spatial complexity refers to the average distance between operating locations (Choi and Hong, 2002).

The existence of these complexities has a direct effect on the interorganizational systems studied in this research. The higher the number of tiers in the studied system for example, the more difficult it gets for the whole network to adopt a common IOS standard, simply because the number of involved parties is higher. A high level of horizontal complexity typically leads to the parallel development and adoption of different IOS standards by competitors. In this case the common customers and suppliers of these firms are faced with numerous differing message standards that results in additional integration costs and potentially less integration in the network.

3.2.2.1 Inefficiencies in supply chains

We can realistically assume bounded rationality for companies, meaning that they do not possess the ability to gather perfect information about their environment, markets, prices and trading partners to counter these complexities. The implications of this assumption is that firms are facing uncertainty in many of their supply chain operations, such as planning to changing demand, inventory control, scheduling, on-time delivery, order processing, etc. Uncertainty can be defined as the difference in the amount of information required to perform a task and the information already possessed by the organization (Galbraith, 1977). Inefficient supply chain management results in overproduction, delays, unnecessary production steps, stocks and increased defects, which in fact leads to poor customer service, lost revenues and missed production and transportation schedules.

Forrester (1973) identifies one of the most well-known problems in SCM: the amplification of demand order variability as orders move up the supply chain, the so-called bullwhip-effect (a.k.a. Forrester-effect). Lee (1997a) argues that the cause is not irrational human behaviour or misconception about inventory management, but rather a consequence of the player's rational behaviour within the supply chain's infrastructure. The bullwhip-effect is attributed to four causes: demand signal processing, batch ordering, price fluctuation and shortage gaming (Lee et al., 1997b). Demand uncertainties and short-run fluctuations lead to more cautious procurement management. To anticipate sudden spikes in demand each tier tends to order larger quantities than they would normally do. Because consumer sales quantity is not passed to upstream levels, the resulting multiple forecasts with prediction errors escalate as the distorted information travels upstream. Inventory space and higher safety stocks become the necessary pay-off to satisfy demand order variability and to ensure customer satisfaction from a single company's point of view. When lead times between re-supply of the items are longer, the fluctuation is even more significant. This is amplified by large batch orders, which occur when companies do not immediately place an order, but accumulate demand. Price fluctuations in the market entice firms to buy forward large quantities, when the price of the product is low further creating examples of inconsistent order history.

3.2.2.2 Lean thinking

The reduction of costs by eliminating waste and delays and the simultaneous improvement of customer satisfaction is the goal of supply chain performance initiatives (Christopher and Towill, 2001). Tighter coordination helps eliminate many non-value-adding activities from internal and external production processes (Frohlich and Westbrook, 2001). Initially, focus was on the optimization of internal processes with the elimination of waste, reduction of inventory, the shortening of setup times

and the improvement of quality. This internal production method is referred to as lean manufacturing. The origins of lean thinking can be traced back to the Toyota Manufacturing System in the 1950s (Ohno, 1998) and to the production of the Spitfire airplanes during World War II. Womack and Jones (1996) apply the concept of leanness to the external environment of the firm, envisioning a seamless flow of goods throughout the whole value chain, creating what they call as the "lean enterprise". The involvement of downstream and upstream partners in lean initiatives can increase the overall efficiency of the chain and helps realizing cost leadership strategies.

The lean concept works well where demand is relatively stable and hence predictable and where product variety is low due to high standardization. However, volume variability in demand or the alteration of product specification makes forecast-based production and distribution problematic. Since changes in future demand are highly unpredictable in these cases, companies cannot rely anymore on historical sales data to schedule their production. Where demand is volatile and the variety of customer requirements is high, production and logistics needs to become more agile to cope with the changes (Christopher, 2000).

3.2.2.3 Agility principle

Agility in essence is an organizational property and many researchers are interested in its applicability and impact on different part of a business such as agile software development (Lyytinen and Rose, 2005), agile manufacturing (Burgess, 1994) and general business agility. There are many diverse and sometimes contradicting definitions of agile manufacturing and the difference between agility, leanness and flexibility is often not clear. Conboy and Fitzgerald (2004)conducts a meta-analysis on the business agility literature and derives a definition of the term:

"Agility is the continual readiness of an entity to rapidly or inherently, proactively or reactively, embraces change, through high quality, simplistic, economic components and relationships with its environment"

The agility principle thus offers a sound solution for firms operating in volatile markets or with non-standardized products. The application of the agile approach to interorganizational processes and exchanges creates an agile supply chain. In order to preserve some flexibility, companies in an agile supply chain no longer concentrate solely on pushing the product through the value chain by efficient scheduling, but also to reserve capacity to cope with demand variability and by the elimination of finished goods inventory. Goods are retained in a semi-assembled or generic form until the customer order is known and then tailored to those product specifications. The finished goods are immediately shipped out to the buyer. This strategic work-in-process inventory is called the customer order decoupling point (Christopher and Towill, 2001). Collaboration on product design with parts- or raw material suppliers helps to push the decoupling point further upstream as the product components become more modular and the goods can be kept in a more generic form. Order specific changes are applied when the order arrives. Agile manufacturing enables companies to achieve high customization and to cope with demand uncertainty with minimal lead times.

Agility and leanness are not mutually exclusive, but rather complimentary philosophies. Up until the decoupling point, production can follow lean principles,

which ensures that the generic inventory is made with maximum efficiency based on forecasts. After the decoupling point a pull-based demand management system controls production and distribution that will maximize effectiveness and product customization. Such a configuration is called a hybrid or leagile system. This property greatly improves customer satisfaction. According to Mason-Jones et al.(2000) the agile design of a supply chain is most important where not the costs, but the service level decides on who the market winner is. Lee (2004) goes further and states that being agile is only one of the three qualifiers of a sustainable advantage next to being able to adapt over time to changing market conditions and to align interests of all firms in the supply network.

3.2.2.4 Agility in the supply network

The alignment of the interests of all parties is a very important point. Realizing an agile or lean supply chain needs more than just the efforts of a single company. The whole supply network needs to adapt a new mindset otherwise efficiency or effectiveness gains of one company are lost on another one. Trading partners need to share information with each other in order to reduce uncertainties and to increase the overall performance of the supply chain. Information sharing is a key ingredient in coordination of supply chain networks (Tan et al., 2000). Suppliers can plan much better when buyers pass demand forecasts, point-of-sale (POS) data or inventory levels upstream. The efficiency of this information sharing and data processing can be greatly improved with the use of information systems. To do this, companies need to agree on several things: the information that is being shared, the way and the format the information is exchanged and on how that information is going to be used.

Companies cannot realize an increase in efficiency by merely investing in new technologies, it is necessary to further invest in changing the supported business processes (Brynjolfsson and Hitt, 1998). Such processes include product development process, procurement process, order processing and forecasting, order fulfilment process, distribution process and customer service support, collectively called supply chain network processes (Tan et al., 2000) or cross-company business processes (Nelson and Shaw, 2003). The coordination and alignment of processes within a supply chain is called supply chain integration (SCI).

Company value chains are transformed to integrated value chains if they are designed to act as an extended enterprise, creating and enhancing customer-perceived value by means of cross-enterprise collaboration (Papazoglou et al., 2000). Through collaboration and increased integration, competition is shifting to the supply chain level from the individual firm level (Christopher, 1992; Williams et al., 2002; Nelson and Shaw, 2003; Holland, 1995). In this way, all members of the chain should have a clear view of the competencies present in the chain and their coherence within the network. All actors should have an insight as to where and how value is created and what contribution they can make based on their own competencies. Such collaboration within the integrated value system assumes an overall agreement, business strategy to which all the members of the supply chain agree to pursue (Hyeon-Soo et al., 1999).

3.2.2.5 SCI initiatives

We can conclude from the SCM literature that SCI ideally requires integration between all supply chain members along the chain on different levels: integration of information systems, integration of business processes and the alignment of SCM strategies. Companies need to overcome organizational boundaries and constraints to jointly manage business processes. Several cross-organizational initiatives have been introduced to improve supply chain performance, such as Quick Response in the apparel industry (Perry et al., 1999), Efficient Consumer Response in the grocery industry (Kurnia and Johnston, 2000), Vendor Managed Inventory (Holmstrom, 1998). An emerging de facto standard is the Collaborative Planning, Forecasting and Replenishment (CPFR) initiative, formulated by the Voluntary Interindustry Commerce Standards organization (VICS). CPFR is a well-defined interorganizational business process whereby supply chain trading partners activate inter-firm coordination mechanisms to jointly plan key supply chain activities, from production and delivery of raw materials to production and delivery of final products to end customers (Danese et al., 2004).

According to Sahin and Robinson (2002) a supply network is fully coordinated when all decisions are aligned to accomplish global system objectives. A lack of coordination due to the presence of internal, supplier and customer barriers however might prevent such level of SCI and initiatives like CPFR will likely remain elusive (Frohlich, 2002). Since information sharing bears such paramount importance in the process, the adoption, implementation and use of electronic information systems are critical components in supply chain integration efforts.

This thesis aims to find out the motivation of companies to integrate or not to integrate their supply chains in general and to adopt or not to adopt various interorganizational information systems (IOS) in particular. In the next section we review the literature on IOS not only to gain an understanding on the current state of knowledge of the field and to help us further position our research, but also to identify a gap in past research, which this thesis intends to bridge with the proposed model in Chapter 4.

3.3 INTERORGANIZATIONAL INFORMATION SYSTEMS

3.3.1 Theoretical base and typologies of IOS

A substantive body of research has investigated the role of information technology in the context of interorganizational relationships. It has long been argued that information technology can have profound effects on the structure and process of inter-firm relationships. This proposition has gained additional importance with the advent of the Internet and resulting increase in electronic business transactions.

The use of a system by two or more organizations is considered necessary and sufficient to qualify a system as interorganizational (Barret and Konsynski, 1982). A slightly different definition states that IOSs are information systems that span organizational boundaries (Gregor and Johnston, 2001). These are rather broad definitions for us to use, since they entail all electronic communication between any types of organizations. Li and Williams (1999) provide a more business oriented

definition that fits our supply network context better: Interorganizational information systems (IOS) refer to computer and telecommunications infrastructure developed, operated and/or used by two or more firms for the purpose of exchanging information that support a business application or process.

3.3.1.1 Frameworks

According to Premkumar (2000) there are three levels of sophistication for an interorganizational system: communication, coordination and cooperation. At its simplest form, firms use IOS to exchange messages electronically, replacing their previous communication means such as telephone and fax. These messages may not be integrated with the rest of the information systems in the organization. The second level of sophistication is coordination, in which computer-to-computer communication is integrated with the internal information system. This allows the automation of order processing and enables better production planning and distribution scheduling. This approach already requires that trading partners share order and customer information with each other and the logistics supplier. The final level of sophistication is cooperation, where business partners share common goals and collaborate on many SCM processes. Information sharing expands to support concurrent engineering (joint product development), joint promotional campaigns. This level of integration is also called vertical quasi-integration (Zaheer and Venkatraman, 1994).

Chatterjee and Ravichandran (2004) provide an integrative framework where distinct approaches toward the study of IOSs are synthesized. Researchers with a transactional view emphasize the significant transactional advantages of using IOS. Reduction of data errors, increase in data accuracy and the reduction of order cycle time are direct, positive effects of automation and less manual handling (Vlosky et al., 1994). Malone et al. (1986) distinguish three different effects information technology has on the business environment: Cost and time reduction of information exchange is called the electronic communication effect. Information regarding supply and demand can be more efficiently shared and matched through electronic marketplaces to create a better fit to the actual demand is called the electronic brokerage effect. The brokerage effect can increase the number of alternatives companies can consider, increase the quality of the alternative eventually selected and decrease the search cost. The third effect is the electronic integration effect, which implies that through the use of IOS, companies can not only enhance their communication capabilities, but can also change joint business processes that create and use the information. Integration of information systems together with business process redesign results in such indirect benefits as less inventory holding cost due to just-in-time deliveries and reduced lead time.

From a transactional point of view the above mentioned effects have a profound influence on the existence of cross-organizational processes. Transaction cost theory (TCT) provides an explanation on the make-or-buy decision of firms, in other words, how much of a given product or service should a firm outsource and how much it should produce/provide in-house? TCT considers markets (outsourcing) and hierarchies (in-house) as the two possible governance forms under which transactions can take place. The trade offs are larger production-, but lower transaction cost under hierarchies and lower production-, but higher transaction cost in markets.

The use of information technologies is able to significantly reduce coordination costs in a transaction due to lower unit cost of communication given the above-described effects. IT helps lowering operations risk as well, because increased information availability, larger transparency and increased information processing capacity improves transaction monitoring and provides more efficient incentive structures. As a result Malone et al. (1986) predicted that the use of IOS will lead to more outsourcing and electronic markets will emerge. Clemons et al., (1993) adds that these effects will not result in pure market transactions, instead governance structures will "move-to-the-middle" of hierarchies and markets, because firms are better off collaborating with only a reduced number of "preferred" trading partners. This hypothesis is strengthened by Bakos and Brynjolfsson (1993), who provide an analysis on the optimal number of suppliers in light of the theory of incomplete contracts and the incentive for partners to invest in non-contractibles, such as innovation, responsiveness and information sharing.

A non-transactional view on the other hand refers to the fact that efficiency enhancement capture little about the actual appropriation of gains from these systems. Value distribution, the mutual sharing of cost and risks of IOS development gives rise to behavioural factors, such as trust and power (Hart and Saunders, 1997; Premkumar and Ramamurthy, 1995). The use of IOS does not only result in efficiency gains, but also has a significant impact on an organization and many organizational factors are expected to influence its use and the decision to adopt the system, beside transaction cost. Studies with a non-transactional view focus on the specificity of an IOS, ownership issues and emphasize indirect benefits, such as differentiated service levels and increase in market share. As a third view on IOS also identifies a research stream with an integrated approach, where both transactional and non-transactional factors are included in the studies (Kurokawa et al., 2008; Chatterjee and Ravichandran, 2004).

3.3.1.2 Classification of IOSs by number of parties involved

We can classify IOS according to the number of parties it connects. One-to-one (1:1) connections are bilateral IOSs that connect dyads and allow information exchange between two parties. The resulting interorganizational relationship is also called an electronic dyad (Choudhury, 1997). A typical technology solution for electronic dyads is Electronic Data Interchange (EDI). EDI uses structured data with agreed message standards to transfer data electronically from one computer to another (Perfett, 1992). EDI is used primarily to electronically transfer repetitive business messages. These include purchase orders, invoice, approval of credit, shipping notices and confirmations. Trading partners need to agree on the message format in order to be able to interpret the received messages, which is normally no more than a numerical sequence and strings. Worldwide-accepted, cross-industry, de facto EDI standards are EDIFACT and ANSI X.12 (Nelson and Shaw, 2003).

The communication channels for EDI messages are private lines or the internet for XML-based EDI. In the past EDI ran on expensive value added networks (VANs). These private, third party managed networks, provided security and high capacity; however, their use was confined to large hardware and software of the telecommunication companies that provided these services. The Internet-based EDI does not have the same security and capacity as VAN-based EDI, however they are cheaper than regular EDI.

One-to-many (1:n) multilateral IOSs are solutions that are centered on a single-firm. Portals and extranets offered by organizations belong to this category. Extranet enable people who are located outside a company to work together with the company's internally located employees. The term extranet comes from "extended intranet". The main goal of extranets is to foster collaboration between business partners. An extranet is open to selected suppliers, customers, and other business partners, who access it through the Internet. It is closed to the general public. Many companies use extranet to simplify and improve customer order entry process and to allow their trading partners to access internal databases or product catalogues.

Many-to-many (n:m) IOSs are electronic marketplaces, auctions and electronic exchanges. Electronic marketplaces are websites that bring multiple buyers and sellers together in one central virtual market space and enable them to buy and sell from each other at a dynamic price that is determined in accordance with the rules of the exchanges (Davila et al., 2003).

3.3.1.3 IOS selection criteria

Given these various types of IOSs, which ones should companies implement and why? Malone et al (1986) predicted that transactions with high asset specificity and high transaction cost should have a hierarchical governance structure while transactions with low asset specificity and low transaction cost can be conducted via markets. Choudhury (1997) finds that the decision is made considering the demand uncertainty and market variability of the product. He argues that multilateral IOSs are more suited to products with a) high technological uncertainty of demand and high market variability or products that have b) low technological uncertainty and low volume uncertainty. High *technological uncertainty* means that the demand is very unpredictable and the buyer cannot predict what will constitute its next purchase order. The wider the range of possible purchased products, the larger the supplier pool will become. Since these orders are unpredictable, they usually result in infrequent orders in small volumes. High *market variability* means that the market for the product is fragmented (many firms with a greater range of products) and highly volatile (prices and players change frequently over time). For purchases with high technological uncertainty and high market variability it is too costly to invest into dedicated IOSs. Multilateral IOSs however offer the required flexibility and search capability for this type of products, because the cost of investment and maintenance is spread across all the infrequent and low volume purchases.

Establishing electronic dyads is preferred when the transaction faces low technology uncertainty, low volume uncertainty and low market variability. In other words, the sourcing of a predictable range of products with non-volatile order sizes can justify the setup of a dedicated IOS with selected suppliers.

After having selected the appropriate IOS type, companies are faced with the decision whether to approach the implementation in a competitive or in a cooperative way. This decision depends on the strategic significance and the bargaining power of the firms. Many authors advocate the importance of a collaborative approach that will eventually align interests and lead to the integration of supply chains (Holland, 1995; Williams et al., 2002), while others question the necessity of all-out collaboration and rather emphasize the development of relationships appropriate to the transaction

(Bensaou and Venkatraman, 1995; Cox, 1997; Cox et al., 2004). This issue is discussed in more detail in section 3.3.3.

3.3.1.4 Research fields within IOS adoption

So far we have discussed the definition of IOS, the differences between views and their implications on research. We also described various typologies of IOS. The field of IOS research has several sub-fields or fields of interest. It is important to make these distinctions in order to focus our research and identify the relevant literature. The IOS field can be divided into the area of adoption, implementation and use of IOS (see Figure 3-1).

Adoption is a decision making process that leads to the adoption decision, a dichotomous decision of an organization to adopt an IOS or not. Adoption of IOS happens when the decision is reached to invest resources necessary to accommodate the implementation effort (Cooper and Zmud, 1990). The implementation stage follows a positive adoption decision. This research area covers mostly technical details of implementation and development, but also studies organizational issues such as business process redesign (BPR) and resistance to change (Piderit, 2000). The third research area concerns the use of IOS. The extent of IOS usage can be operationalized on several dimensions, such as transaction volume, diversity of messages and number of trading partners that are utilizing the technology (Massetti and Zmud, 1996). This field is dominated by technological imperative (Markus and Robey, 1988) where technology is considered a strong driver and a source for organizational change. Studies in this field examine how the introduction and use of IOS changes various aspects of organizations, e.g. performance, structure, power distribution, interorganizational relationships, industry structure, etc. (Chi et al., 2008) for example, combines social network analysis with IOS research and concludes that the use of IOS has an effect on the structure of business networks and on the competitive behavior of the parties involved in the network.

Our research falls under the first field, namely IOS adoption. The next section narrows our focus and discusses the literature on this sub-field. This will allow us to identify the contribution our research intends to add to the existing knowledge base in IOS adoption.

3.3.2 Adoption of IOS

Research on the adoption of IOS already has a long history. Electronic data interchange (EDI) has been used for more than 30 years now (Stefansson, 2002) to exchange structured data electronically in a standardized format between organizations (O'Callaghan and Turner, 1995) and is being intensively researched since the mid 1980s (Chan and Swatman, 1998). Faced with variable IOS adoption success, researchers have adopted a wide range of approaches, methods and theories to understand and explain the phenomena.

3.3.2.1 Stage model of the IOS adoption field

Somasundaram and Rose (2003) provides an excellent account on the history of the field. They reviewed 72 important contributions to trace the emergence and development of the IOS adoption concept. As a result they identify three conceptual stages in the literature: rationalizing, probing and understanding stages.

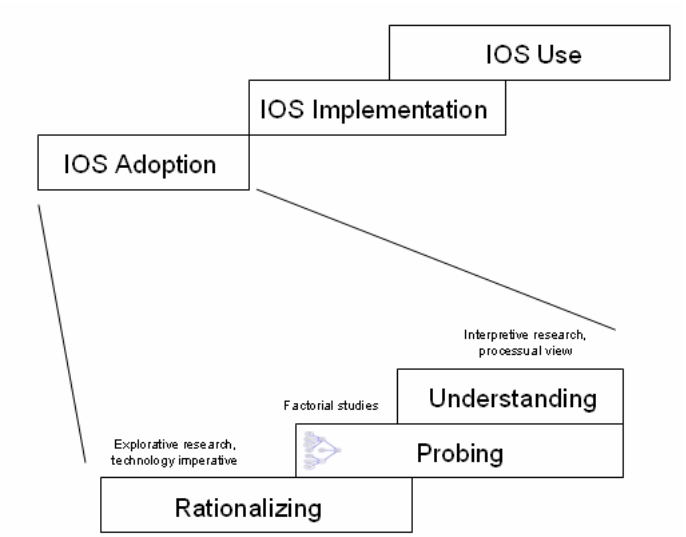

Figure 3-1: Stages in IOS adoption research

The rationalizing stage is characterized by initial explorative studies and by the extensive reliance on transaction cost theory. The causal agency in these early researches is attributed to a "technology imperative" with the assumption that IOS brings competitive advantage. Adoption was viewed typically from a single company perspective where trading partners are part of the environment. Competition and opportunism characterized the environment and interaction with the company was assumed to be unidirectional.

By the 1990s the research approach changed as failures in IOS adoption surfaced. Many studies started to "probe" the reasons of successful and non-successful adoptions, predominantly using the factorial approach. In factor research, theories assume that a number of predicting variables determine actions or decisions regarding the adoption (Kurnia and Johnston, 2000). These predicting variables are called factors. In these studies, according to Somasundaram and Rose (2003), the adoption of technology/innovation is assumed to be beneficial and non-adoption implied to be failure. In the early years of the probing stage researchers conducted case studies to understand the complexity of phenomena (Moore and Benbasat, 1991; Premkumar and Ramamurthy, 1995; Iacovou et al., 1995). Later, emerging models were empirically tested and validated on large-scale samples. The most influential models in the probing stage use the factor approach.

Many researchers find previous explanations of IOS adoption simplistic and inadequate. Instead of regarding adoption as the product of a set of contextual factors, the effect is assumed to be bi-directional instead of being unidirectional. Organizations affect and are being affected by their environment at the same time. This thinking resulted in theories with a more processual approach in the late 90s. Using the terminology of Markus and Robey (1988), process theories use emergent causality and process logical structure as opposed to the situational control and variance model of the factor approach (Kurnia and Johnston, 2000; 2001). Process theorist attempt to understand the complex and dynamic nature of IOS by closely interacting with the adoption context. The advent of process theories mark the

understanding stage in the history of IOS adoption research. Currently both the probing and the understanding stage have numerous proponents.

The parallel development of two distinct approaches creates a slight rift in the field. Some researchers welcome the diversity in philosophical views and consider them complementary (Mingers, 2001; Kurnia and Johnston, 2000). They view positivist factor based research as a necessary first step to understand the relationship between multiple independent variables and IOS adoption. The resulting models can then be improved by "second order" interpretative studies to establish bi-directional relations. Others find positivist and interpretative philosophies incommensurable and argue against cross-paradigmatic research (Falconer and Mackay, 1999). Damsgaard and Lyytinen (1998) term factor based approaches inadequate for studying the complex phenomena of IOS adoption. Although positivist studies dominated in the earlier stages of IOS adoption research, interpretative studies are gaining ground. Somasundaram and Karlsbjerg (2003) calls for the combination of the insights from positivist and interpretivist studies for the sake of scientific progress.

3.3.2.2 Theoretical perspectives

IOS adoption is a complex phenomenon, because it spans organizational boundaries, has a profound effect on internal processes and is influenced by several factors from various levels of analysis. In the history of the field, researchers therefore used various theoretical perspectives to model adoption.

The most often used theoretical base for IOS adoption studies is diffusion of innovation. The diffusion of a technology is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 1995). Innovation is an idea, practice or object that is perceived as new by an individual or other unit of adoption. IOS is considered to be an innovation and the research problems are centered around the question: how does the technology get diffused among the members of an industry or a supply network. Here, adoption by individual firms is the building block toward system-wide diffusion. The downside of this theoretical perspective is the so called pro-innovation bias; the implication that an innovation should be diffused and adopted by all members of a social system, that it should be diffused more rapidly and that the innovations should be not re-invented nor rejected. In other words, non-adoption cases are considered to be failures.

Diffusion theory distinguishes two types of innovation-decisions. Optional innovation-decisions are choices to adopt or reject an innovation that are made by an individual independent of the decisions by other members of the system. Collective innovation-decisions on the other hand are choices to adopt or reject an innovation that are made by consensus among the members of a system. In the latter case benefits from adopting the technology increase as more members of the system adopt it. This feedback mechanism has been observed to be present in electronic marketplaces (Bakos, 1991; 1997; Somasundaram, 2004), electronic payment systems (Johnston, 2006) and in the choice of EDI standards in certain industries (O'Callaghan and Turner, 1995; Williams, 1997) and is generally called critical mass theory.

Critical mass theory stems from nuclear physics in where it denotes the minimum amount of nuclear material that must be present for a self sustaining nuclear fission reaction to occur (Oliver et al., 1985). Social science researchers have applied the critical mass notion for explaining the diffusion of innovations and now it is

recognized for its potential to explain the adoption decision process (Somasundaram and Rose, 2003). The implication of critical mass theory to adoption studies is that decision of other members of the system has an effect of the individual decision outcomes.

What makes IOS an interesting technology to study is that it requires two or more organizations to agree upon its implementation, on the standards and message formats to use therefore an adoption decision depends heavily on the other parties (Chan and Swatman, 1998). With this in mind it is more appropriate to talk about the co-adoption of technology rather than focusing only on an individual organization (Nelson et al., 2002). Socio-political factors, such as inter-firm power relationships and trust come in to play an important role in the decision-making process (Kurokawa et al., 2008; Yeung et al., 2009). The presence of trust between organizations often found to be facilitator of IOS adoption and powerful buyers typically impose their communication standards on smaller suppliers (Hart and Saunders, 1997). We are going to discuss power issues in greater detail in section 3.4.

3.3.2.3 Levels of analysis

We can apply all research approaches and theoretical perspectives on various levels of analysis. The complexity of the phenomena makes this distinction necessary, because for example the nature of interorganizational relationships and the presence of network externalities has an effect just as well on IOS adoption as such internal factors like IT maturity, readiness of an organization and the mindset of the management. Damsgaard and Lyytinen (1998) suggests using three broad levels of analysis: micro, mesa and macro level.

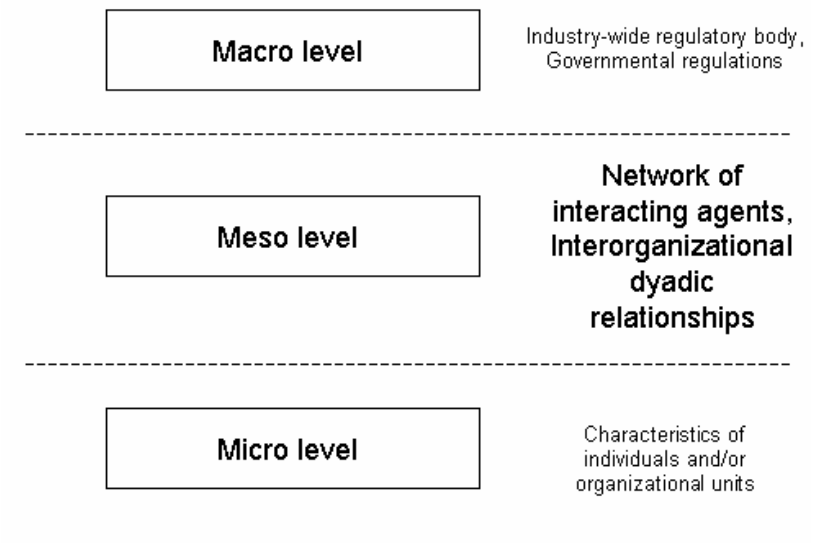

Figure 3-2: Three levels of analysis for the study of IOS adoption

Micro level analysis focuses on characteristics of individuals and/or organizational units. In particular these studies concentrate on intra-organizational issues including user-awareness, resistance to change, internal politics, power shifts and technology acceptance. Harrison et al (1997) applied theory of planned behaviour (TPB) to explain and predict small business executives' decision to adopt IT.

Meso level studies look at the interaction of various agents within a network. Firms do not operate in a vacuum they are part of a larger supply network where certain power structure is present (Cox et al., 2002). This level is useful to understand how organizational power and industry structure are being shaped by the adoption of IOS solutions and to what extent diffusion is contingent upon interorganizational characteristics. Network externalities and critical mass theories typically operate on the meso level. The role of advisors, promoters and facilitators as third parties is also being included in the latest studies (Kurnia et al., 2006).

On the macro level, the presence of industry wide regulatory bodies, trade and professional associations, EDI standard bodies, government regulations and government sponsored IT councils is being considered as an additional driving force toward diffusion. Teo et al., (2003) has shown that institutional pressures had a significant influence on organizational intention to adopt financial EDI. Institutional variables greatly affected the electronic integration of the Australian beef industry (Gregor and Menzies, 2000) and the healthcare sector (McGrath and More, 2001).

3.3.3 Reasons for adoption and non-adoption of IOS

So far we have discussed what IOS adoption is and how supply chain management can benefit from using an interorganizational system. There are two more significant attributes we have to look at in order to get a complete understanding of the IOS adoption phenomena. These are the potential disadvantages of an adoption and the barriers that might be present on an organizational or interorganizational level that could prevent a successful electronic integration. We selected 18 research articles from the field, which had either proposed their own model for IOS adoption or had added new insights to the existing body of knowledge. Table 3-1 gives an overview of the findings from each article regarding the benefits, advantages and barriers to adoption.

Article	IOS type	IOS advantage	IOS disadvantage	IOS inhibitors
(Chan and Swatman, 1998)	EDI	Reduced order lead time Improved level of service to customers Reduced labor costs Fewer errors in ordering More efficient business processes		Incompatibility High cost Complexity User resistance
(Christiaanse and Markus, 2002)	B2B EMP	Integration benefit – Tightened process coupling Communication effect – efficient information flow Brokerage effect – improved matching	Asset specific investments Critical mass for effective use	Power relationships – lower prices (Bakos, 1997) cause resistance from suppliers
(Damsgaard and Lyytinen, 1998)	EDI	**Direct benefits:** Better efficiency of internal operations Better responsiveness Rapid and less error prone request Quick & accurate placement and cancellation orders Automation of administrative process. Optimization of inventory level **Indirect benefits:** Demonstration of competency Increase in organizational reliability Improved accountability Better monitoring of environment		

Article	IOS type	IOS advantage	IOS disadvantage	IOS inhibitors
(Frohlich, 2002)	E-integration	Quick and reliable product delivery Short lead times		No perceived benefits Current business model practice Lack of skills
(Hart and Saunders, 1997)	EDI	Reducing time lag with document delivery More effective methods for coordination	New uncertainties Increase in interdependence Information transparency introduces new source of vulnerability Shift in the nature of expectations regarding the other's performance	High cost of implementation Reliance on paper-based methods Lack of legacy system integration
(Kurnia and Johnston, 2001)	ECR	Efficiency in promotion Efficiency in product development Efficiency in product replenishment Efficiency in store assortment		ECR creates barriers to its own adoption. It requires cooperation and trust and these unlikely to happen unless costs, benefits and risks are mutually shared.
(Kurokawa et al., 2008)	EDI	Creating value by closer linkages among companies Efficiency gain by automating processes	Assymetric benefits High cost	Powerful firms may reject adoption Network position: being a Low tier automotive supplier
(Li and Williams, 1999)	IOS	Several		Technological: System reliability Lack of standards Reluctance to information sharing Incompatible organizational cultures, structure, procedures, languages, accountabilities and time required to manage relationship
(McGrath and More, 2001)	Extranet			Cost of data clean-up operations Costs of developing and maintaining interfaces Inconsistencies between partner organization
(Meier, 1995)	EDI	Cost savings from automation Reduce time delays Increasing responsiveness Strengthening trading relationship Higher switching costs	Post contractual dependence	

Article	IOS type	IOS advantage	IOS disadvantage	IOS inhibitors
(Messmer, 1995)	XML-EDI	Less expensive than EDI SMEs can use it	Not appropriate for all traffic Same security server must be installed New trading partner agreements No more message management by VAN	
(Mithas et al., 2002)	E-market Reverse auction			*Noncontractible factors:* Quality attributes Innovation Information sharing Flexibility Partner responsiveness
(Morell and Ezingeard, 2002)	IOS	Efficiency Effectiveness		Incompatibility of systems Financial – economic cost Impact of sharing information Post contractual power shift Expensive translation software
(Prokein and Faupel, 2006)	Web services	Reduction of transaction cost Interoperability Flexibility Effective and efficient business processes		Lack of know-how Insufficient standardization Complex integration Security worries Opportunism by trading partner Lack of trust
(Stefansson, 2002)	EDI			Small size Routines for data sharing missing Do not have right IT Do not have resources Do not see benefits Number of transactions are small
(Tan and Raman, 2002)	IOS	Depend on the firm's internal contingencies		Coordination and cooperation Partner resistance Lack of cooperative relationship

Article	IOS type	IOS advantage	IOS disadvantage	IOS inhibitors
(Vlosky et al., 1994)	EDI	Increase efficiency of product flow Competitive advantage – lower cost Tighter links to customers Increased product differentiation Reduce data errors Increase data accuracy Reduce order cycle time Speed up product replenishment Quick response		
(Webster, 1995)	EDI	Reducing supplier base Just in time inventory management Quick response		Reason for conflict: power differences
(Wells et al., 2001)	E-partner-ship	Automating inventory replenishment Replacing traditional sales channels	Post contractual dependency and vulnerability	Power

Table 3-1: Benefits, disadvantages and barriers of IOS adoption

IOS enables higher visibility between trading partners and support the struggle to lower demand uncertainty. In the context of supply chains they enable integration between trading partners through faster, more efficient and more accurate data exchange, thus offering ample benefits for companies. Direct benefits are cost saving from automation, efficiency gains, reduction of data errors, optimization of inventory levels and reduced order cycle time. The use of IOS also offers ample indirect benefits, such as increasing responsiveness, improvement of trading relations, demonstration of competency, increase in organizational reliability, better customer service and improved accountability.

Several factors can lead however to a lack of intention in adopting an information system: the company does not see the benefits in the technology or it does not perceive added value by adopting another IOS in case it already had a different system in place with other trading partners. Costs of implementing an IOS could discourage firms especially when it necessitates change in business processes. The perception that the investment has a high risk on the technical, operational or strategic level negatively affects the intention to adopt as well (Hughes et al., 2004).

Such risks are that the technology will become obsolete (Kumar and Dissel, 1996), the trading partner will act opportunistically and the IOS has a high asset specificity (which means that the investment will only have value in one particular function and relationship and less or no value in others) (Williamson, 1979). One of the most commonly mentioned fears of potential adopters is the post-contractual dependence on the co-adopting partner (Meier, 1995; Hart and Saunders, 1998; Wells et al., 2001) that might lead to getting locked-in into the relationship (Lonsdale, 2001). Lock-in occurs when one organization invest substantially into relation specific assets, which increases cost of switching to other companies in the future. Closed IOSs are characterized by proprietary messaging standards and specific business processes, therefore those are associated with high switching costs and firms are less inclined to adopt them.

Inhibitors are factors whose presence can act as a barrier towards adoption. We divide these barriers into technological/organizational and internal/external dimensions. Technological barriers are lack of IT maturity (Iacovou et al., 1995), lack of skills (Frohlich, 2002), lack of back-end legacy system integration (Hart and Saunders, 1997), lack of standards (Li and Williams, 1999) and incompatibility of systems (Morell and Ezingeard, 2002). Firms have to develop in-house information systems before they can effectively implement interorganizational linkages. Internal organizational issues are business process redesign and resistance to change. Frohlich (2002) found that companies neglecting their internal obstacles stand a very small chance of successfully implementing electronic integration solutions.

Overcoming internal barriers is a necessary, but not a sufficient condition to IOS adoption. As we have mentioned earlier IOS is about co-adoption of the technology therefore external conditions have to be met as well. Technological and financial readiness of the suppliers and the customers of the focal company constitute external technological barriers. It is the external organizational barriers, which are the most often cited inhibitors by the authors in Table 3-1. Most authors note power differences as being the source of conflict between organizations that prevents IOS adoption. A non-cooperative atmosphere lowers trust in the relationship, which in turn leads to unwillingness to share information and to lack of coordination. A non-cooperative atmosphere persists when costs, benefits and risks are not mutually shared by the co-adopting parties. Interestingly, the inhibiting effect of power relationship is not incorporated into current, accepted IOS adoption models.

3.3.4 Latest understanding of IOS adoption

Somasundaram and Rose (2003) concludes their review of the field by calling the model of Iacovou et al. (1995) as “our latest understanding of the IOS adoption phenomenon”. The model has been tested by many researchers ever since (Heck and Ribbers, 1999; Chwelos et al., 2001) and it became well accepted in the field. This model incorporates many of the factors previously demonstrated to be significant predictors of EDI Adoption. This model builds on a significant stream of research including: O'Callaghan et al. (1992), Saunders and Clark (1992).

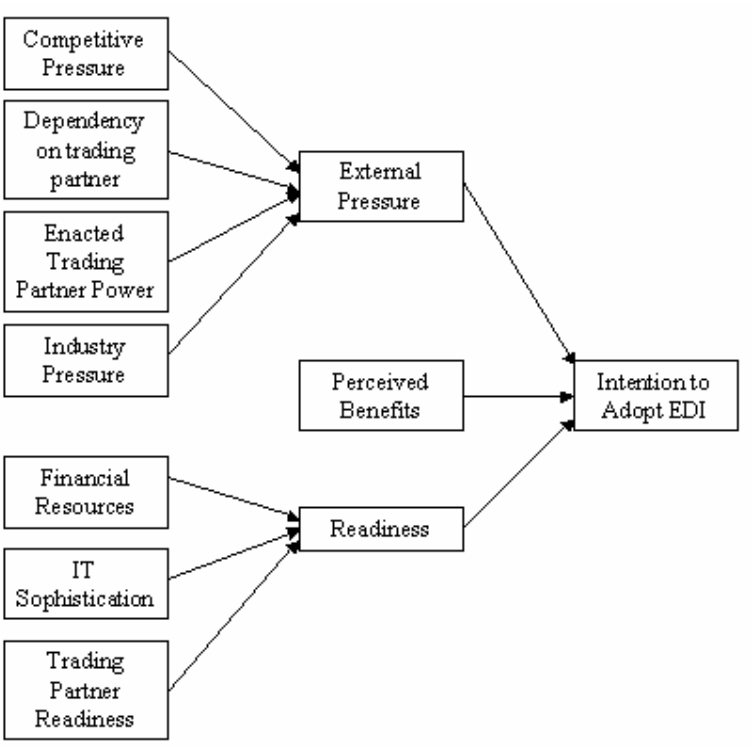

Figure 3-3: Iacovou et al. (1995) Model on EDI Adoption refined by (Chwelos et al., 2001)

The dependent variable of the model is the intention to adopt EDI and it is predicted by three constructs: readiness, perceived benefits and external pressure. Perceived benefits refer to the anticipated advantages that EDI can provide the organization, both direct and indirect effects. Organizational readiness includes internal and external technological and financial measures to determine whether the trading partners are actually capable of implementing the system. The external pressure construct encapsulates the influences arising from several sources within the environment, such as trading partner pressure and industry pressure.

The Iacovou model represents the "current" factorial model. Kurnia and Johnston (2000) introduced the first-order model of the processual approach. In this model organizational action was subject to the company's perception of the technology (relative advantage, compatibility, triability, risks) and of the capability of its own organization (Management commitment, communication openness, flexibility, internal technological readiness). The likelihood of adoption is also affected by external factors, such as pressure from trading partner, trust and mutual sharing of costs and benefits.

The second-order model views fewer factors as being external to the organization. This model suggests that companies are not complete victims of their environment, but are able to change corporate relations, trust, power relations and mutual sharing of costs and benefits through negotiations. These factors become part of the internal industry interactions (Kurnia and Johnston, 2001). Socio-economic conditions, unpredictable demand are still factors that remain out of control from the focal

organization. By considering interaction between trading partners this model can be viewed as more of an emergent perspective of adoption.

Kurnia and Johnston (2006) further extend this model by including third-party organizations. Standard bodies, trade associations, business consultants and researchers can have a notable effect on the adoption process. Third parties play various roles like advisor, researcher, educator, promoter and facilitator.

3.4 POWER AND IOS ADOPTION

3.4.1 Conflicting interests in supply networks

Our literature review has shown that external organizational factors can act as significant barriers to adoption. Lack of cooperation, power asymmetry and post-contractual dependence are all potential inhibitors. Why do we need to study power relations when the benefits of electronic integration are so well documented? Why co-adoption is sometimes so hard to achieve and why is the diffusion of a single IOS technology throughout a supply network often a remains a dream rather then becomes reality?

Gregor and Johnston (2001) finds that the adoption of IOS across an industry group is dependent on the current industry structure. Forster and Regan (2001) observes that the use of electronic integration as a strategy […] is limited by the supply chain environment and the quality of the partnership between firms in the supply chain. Despite much of the rhetoric about partnershipping, the practice of working closer together still has a long way to go (Fernie, 1994). There are two types of inherent conflicts of interest present in supply networks: 1) a conflict between individual firm goals and supply chain level goals; 2) a conflict of interest between buyers and sellers.

3.4.1.1 Type I conflict

We call the conflict of interest between firm- and supply chain level, type I conflict. Competition is increasingly shifting to the supply chain level from a single firm level. This means that members of a supply chain ought to act together towards a common goal in order to remain competitive. These goals are: the increase of market share for the product/service the SC is producing and the maximization of the profit from it. SCs can achieve this by maximizing the value proposition to end customers (low price, value added features, value added services) and by reducing costs internally thereby maximizing effectiveness and efficiency throughout the supply chain. These are the goals and various supply chain management approaches we described in section 3.2.2. The philosophical basis of the supply chain integration is that it is necessary for firms to recognize their shared interests to act in an open, trusting and transparent manner to serve those shared interests (Sanderson, 2004). Moreover it is argued that only by being truly transparent with one another will the firms in a supply network uncover those activities and processes, which are carried out inefficiently (Lamming, 1996).

We assume the rationality of supply chain members and that their primary goal is to maximize their own value appropriation. Each individual company within a supply network has to maximize shareholder value and eventually earn money. If organizations could not make money from producing and delivering goods and services to consumers, then even if people wanted or needed things, it is highly improbable that they would receive them (Cox et al., 2001). In order to satisfy SC level goals some firms might have to perform sub-optimal. From an individual firm point of view this is not desirable and value-maximizing behaviour would still dominate their individual mindset over the strife for increased value proposition to the end customer. Pursuing supply chain-level goals are often argued to be beneficial to all SC members, because it "increases the size of the pie". Once the supply network has reached its goal of obtaining a larger pie, it is still faced with the problem of cutting the pie, which is a metaphor for value distribution among the trading partners (Ramsay, 2004). This leads us to Type II conflict.

3.4.1.2 Type II conflict

This type of conflict refers to the value distribution in a dyadic exchange relationship. To understand what a business transaction involves requires a basic understanding of what the goals of buyers and suppliers are when they enter into an exchange relationship. Both parties in general have the same value appropriation goal (profits), but they have dissimilar operational and commercial goals (Cox, 2004b). The buyer is interested in maximising the value for money it receives from the supplier by increasing functionality and services and at the same time reducing the total cost of ownership. The supplier on the other hand is interested in increasing the share of customer and market revenue while constantly increasing the price with added functionality to keep its returns high.

The ideal outcomes for the buyer and the supplier are not fully commensurable and they are not reachable for both parties in the dyadic relationship at the same time. This however does not mean that mutuality does not exist in dyads and that there are no win-win situations. Cox (2004b) argues that the assumption that mutuality can only occur with an ideal outcome for both parties (in which both parties fully achieve their goals) needs to be relaxed. This allows us to accept that mutuality and win-win situation can still exist when either one or both parties achieve only partially their value capture goals. Figure 3-4 illustrates the possible outcomes for buyers and sellers from a transactional exchange. "Lose" outcomes here imply that both or one party fail to achieve their basic value capture goals – that is they work with the other party operationally (to provide or receive goods and/or services), but do not achieve their basic commercial goals. Win-lose situations are not sustainable relationships over time.

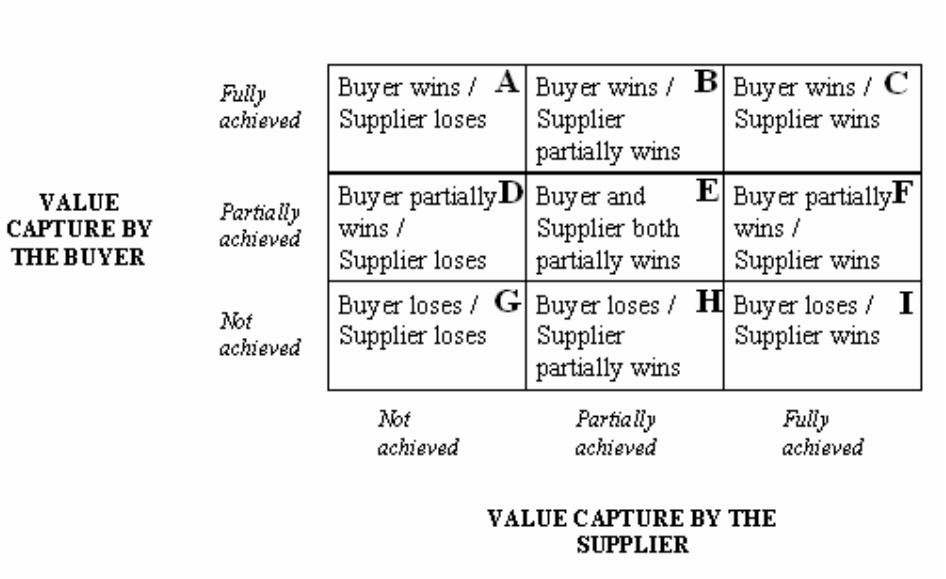

Figure 3-4: Possible outcomes for buyers and sellers from a transactional exchange (Source: Cox, 2004)

Given the assumptions that Type I and Type II conflict is present in the supply network, it is impossible to achieve a complete win-win situation (cell C), therefore only cell B, E and F are viable options. Since none of these scenarios are ideal for either party, type II conflict is always present in a dyadic relationship.

This argument is also present in the works of (Robson and Rawnsley, 2001; Ireland, 2004; Sanderson, 2004; Ramsay, 2004) and supports the viability of the type II conflict assumption.

3.4.2 Conceptualizing power in IS research

The presence of type I and type II conflict in the context of supply networks thus necessitates the inclusion of the concept of power in IOS adoption studies. In recent years, mainstream MIS and management researchers have shown a steady interest in the role of power when viewing information technology (Jasperson et al., 2002). IS researchers have suggested that intention models or behavioural decision theories from social psychology can provide a foundation for research on IT adoption by firms. (Swanson, 1982). According to Ghoshal (2005), current information integration research for supply chains is not adequately taking into consideration human behavioral issues. Behavioral issues are still prevalent. Premkumar and Ramamurthy (1995) urges future research to probe deeper into different aspects of power relationship and to identify and measure the bases of power (or potential power) and examine their impact on EDI implementation.

The seminal article by Emerson (1962), which presents a theory to study power in complex networks had a great influence on the research on the role of power in IOS adoption. According to Emerson, power resides implicitly in the other's dependency. Resource dependence theory (Pfeffer and Salancik, 1978) broadened the view of dependence to interorganizational relationships and they propose that firms depend on their external environment to the extent of the resources they need, but do not control,

hence they should strive for the acquisition of those resources to decrease their dependence. In the supply chain management literature Cox et al. (2002) bring this view further in their research on value distribution along the supply chain by defining power as the ability of a firm to own and control critical assets in markets and supply chains that allow it to sustain its ability to appropriate and accumulate value for itself by constantly leveraging its customers, competitors and suppliers. Critical assets are supply chain resources that combine high utility with relative scarcity in a buyer-supplier exchange and in a market context. This definition relies heavily on the resource-based view (Barney, 1991) in identifying the properties of those critical assets and on Emerson (1962), where dependence is a function of availability (relative scarcity) and motivational investment (utility).

Power is a messy, elusive concept and is difficult to research (Pfeffer and Salancik, 1978). Research on power is further complicated by the multiple paradigms that have been used to understand the interrelationships between power and IT. Jasperson et al. (2002) provide an excellent review on power and its use in IT research. They find that there are different views on the role of power and thereby its definition varies from research to research. Common themes in power conceptualization are authority (structural power, hierarchical origins), centralization (knowledge based, decision rights, zero sum power considering ownership of resources), influence (exercise of power) and politics (zero sum political games, social structures). In order to provide a complete and meaningful categorization of the use of power in the IT literature, the article employs two sets of theoretical lenses: technology lenses and power lenses.

Technology lenses reveal the authors' belief about the nature of causality, whether external forces cause change (technological lens), whether people act purposefully to accomplish intended objectives (organizational lens) or whether changes emerge unpredictably from the interaction of people and events (emergent lens) (Markus and Robey, 1988).

Power lenses highlight the different aspects of the roles of power in IT research. Four aspects are distinguished based on Brandshaw-Camball and Murray (1991): rational, pluralist, interpretive and radical views. The rational view focuses on how IT and structural power affect a collective's ability to achieve its specific goals. The pluralist perspective defines power in terms of actors' ability to influence others' behaviours. Pluralists accept conflict as the norm and that power plays arise from differing interests of the involved parties. The interpretative power lens assumes that reality is socially constructed and that parties involved exert influence by constructing the meaning of what others experience with the use of symbols and language. The radical view on power sees power as the result of social structures, such as class, race, gender or institutional structures. Studies with the radical lens view information technology as a powerful force that causes changes in the organizational and societal structures.

The combination of technology and power lenses results in 12 different conceptualisation of power in IT research. Moreover, power relations have been studied on the individual, group, organizational and inter-organizational levels. Therefore before we define power and describe its role on the co-adoption of IOS, it is necessary to identify, how do we conceptualize power in this research. Our approach falls into the organizational-pluralist category. Organizational, because we emphasize the role of power and political action in designing, developing and adopting IT. Pluralist, because we look at how power influences behavior and decision-making.

3.4.3 The role of power in IOS adoption

We define power as the capability of a firm to exert influence on another firm to act in a prescribed manner, in the light of the organizational-pluralist approach (Hart and Saunders, 1997). In IOS adoption research, power is mostly considered to play a role when trading partners resist adopting an information system. In such cases, more powerful companies can abuse the dependence of the other organizations and make them adopt the IOS despite their lack of interest in the project.

In section 3.3.2.2 we have already mentioned that the IOS field is suffering from the adoption bias, which means that most of the research work considers adoption as a desirable outcome, whereas non-adoption is seen as failure. Most research views power in a unidirectional way, where power is represented as a force toward adoption, most of the time operationalized as an "external pressure" (Gregor and Johnston, 2001; Kurokawa and Manabe, 2002; Meier, 1995; Premkumar and Ramamurthy, 1995; Somasundaram and Karlsbjerg, 2003; Kurnia and Johnston, 2000). Small and medium sized enterprises (SMEs) are often forced to adopt IOS by larger organizations in the supply chain (Iacovou et al., 1995; Heck and Ribbers, 1999; Ling, 2001).

A small number of studies seem to have overcome this adoption bias. Webster and Watson (2002) and Wells (2001) list the behavioral aspect of a relationship where power can act as a potential inhibitor to adoption. A more recent study states that power and interest are of eminent importance in the process of shaping and applying an IOS (Boonstra and de Vries, 2005). The authors introduce a framework where the two concepts are measured in an attempt to identify strategies in managing stakeholders around IOS (Boonstra and De Vries, 2008). Our study builds on similar theoretical grounds, but extends the study of power and interest to dyadic relationships and networks of dyadic relationships.

The presence of power difference does not mean that it is being used. When there is a power imbalance between two trading partners, potential power relationship exists. Potential power is a source of influence even when it is not exercised. The dependent partner might act upon the belief of what the more powerful firm wants, thereby improving its relationship proactively. Exercising power can be done in various ways and the choice has high impact on the interorganizational relationship. Hart and Saunders (1997) distinguishes coercive and persuasive use of power. The coercive approach focuses on punishment in case of non-compliance, for example additional costs and requirements or switching to another trading partner and cease doing business with the non-compliant. The coercive approach implies that the relationship is viewed as expendable and is typically used in supply networks where the more powerful firm can choose from a large pool of potential trading partners. Coercion frequently reflects a short-term perspective.

Power can also be exercised in a persuasive way. With this approach the more powerful firm tries to create incentives for the trading partner to adopt the IOS. Such incentives are cost sharing, education about the technology and its organizational implications and various other supplier development initiatives (Krause et al., 1998). Rather than forcing the trading partners to adopt a technology at the risk of losing them, persuasion induces trust in the relationship and signals a long-term dedication (Hart and Saunders, 1997).

3.4.4 Operationalization of power in IOS research

The source and extent of relative dependence are determinants of power that represent the firm's capacity to influence change in another firm. We sampled 18 articles from the field of IOS adoption that included power or dependence in their analysis and reviewed their way of operationalizing the construct. Table 3-2 lists the variables and the respective articles in which they are used. The articles are ordered chronologically to show when various variables were introduced and to what extent were those reapplied again in later research.

	Grover, 1993	Vlosky, Smith and Wilson, 1994	Iacovou et al., 1995	Premkumar and Ramamurtthy, 1995	Webster, 1995	Kumar and Dissel, 1996	Hart and Saunders, 1997	Williams, 1997	Damsgaard and Lyytinen, 1998	Hart and Saunders, 1998	Frohlich and Westbrook, 2002	Chwelos et al., 2001	Kurnia and Johnston, 2000	Gregor and Johnston, 2001	Christiaanse and Markus, 2002	Forster and Regan,, 2001	Kurokawa and Manabe, 2002	Tan and Raman, 2002	Kurokawa and Manabe, 2008	Boonstra and de Vries, 2008
Dependence on trading partner	X			X			X		X	X		X				X	X		X	X
Large volume purchases	X									X										
Substitutability	X																			
Switching cost	X			X																
Asymmetry		X													X					
Competitive pressure			X	X							X	X						X	X	
Industry pressure			X	X							X	X		X				X		X
Importance of partner				X						X										
Influence by other party				X			X			X	X		X					X		
Sales\Total revenue				X			X			X										
Cartels					X															X
Competitive behavior					X															
Expertise by hub					X															
Industry structure					X	X							X	X						
Proprietary network					X															
Size of partner					X										X					
Extent of influence							X									X				
Supplier\buyer pool size							X			X							X		X	
Satisfy customer request								X												
Enacted Trading Partner Power												X								
Critical input for buyer															X					
Control over technology																				X
Formal authority																				X

* extended from Nagy (2004)

Table 3-2: Operationalization of power in the IOS adoption literature

The operationalization of power in the IOS literature is rather inconsistent. Articles, which do not focus on power use proxies like dependence and influence on trading partner. Power resides implicitly on the other's dependency and the power of A over

B is equal to, and based upon, the dependence of B upon A (Emerson, 1962). This reciprocal relation invalidates the idea that power is simply operationalized as dependence. The next task is to identify the sources of dependence. We mentioned earlier (in section 3.4.2) that organizational dependence is subject to the ownership of critical assets that combine high utility with relative scarcity.

High utility is represented in our sample by variables like "large volume of purchases", "importance of partner", "sales per total revenue" and "critical input for buyer". Relative scarcity could be found as "substitutability", "switching cost", "expertise by hub" (referring to domain knowledge advantage), "supplier/buyer pool size". Although the list of variables for operationalizing dependence seems complete, none of the articles addressed these metrics sufficiently.

3.4.5 The power perspective

The IOS adoption literature seems to be weak on power analysis therefore we looked elsewhere to find appropriate measures. Recently, an influential series of research has emerged from the supply chain management literature, called the power perspective. A book (Cox et al., 2002) and two special issues of the journal of supply chain management were dedicated to introduce and elaborate on the various aspects of this theory.

The power perspective builds on the seminal work of Emerson (1962) and the resource dependence theory (Pfeffer and Salancik, 1978) to analyze interorganizational relationships in supply chains, to explain value distribution and to advise on appropriate SC management strategies. It proposes that dyadic power structures matter for an understanding of opportunity and constraint in business-to-business relationship management. It assumes rationality of the players and maximization of goal achievement, much like we do. The power perspective defines power as the ability of a firm to own and control critical assets in markets and supply chains that allow it to sustain its ability to appropriate and accumulate value for itself by constantly leveraging its customers, competitors and suppliers (Cox et al., 2002).

Dependency of one actor upon another is a function of relative utility and scarcity of the resources the other possesses. Applying this to both the buyer and the supplier in a dyadic relationship we get two measures of dependency: buyer's dependence on the supplier and vice versa. Cox et al. (2000) combines these variables into the so called power matrix (see Figure 3-5). Each cell of the matrix represents a possible power structure in a dyadic relationship.

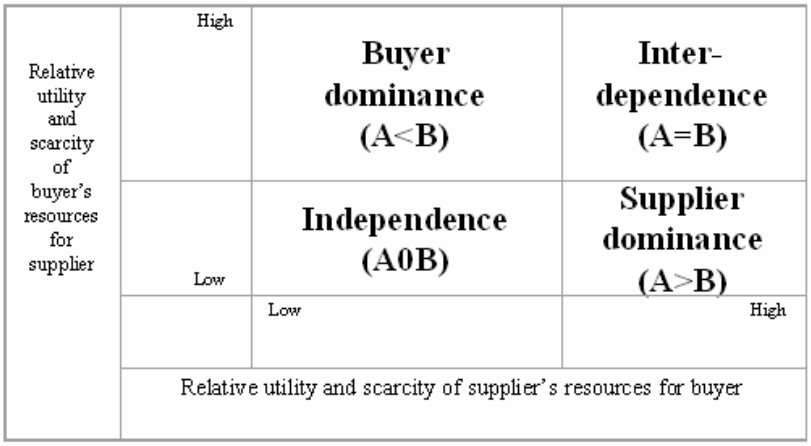

Figure 3-5: Potential power structures for a dyadic exchange

In the buyer dominance box the buyer has power attributes relative to the supplier that provide the bases for buyer to leverage the supplier's performance, quality and ensure that the supplier receives only normal returns. In a supplier dominance situation the supplier in the dyad has the power advantage. It successfully managed to close the market to competitors, raised entry barriers and acquired valuable resources that have high utility for the buyer.

When both parties own resources that are highly valuable to the other and are relatively scarce, dependence is mutual. This forces both the buyer and the supplier to work closely together in the relationship, because none of them can force the other to do what it does not wish to do. The power structure in this case is called interdependence. On the other hand, independence is a power structure where neither the buyer nor the supplier has significant leverage opportunities.

The advantage of power structures being dyadic power typologies is that they can be used to map entire supply networks dyad by dyad. This mapping is used to analyze value distribution in various industries (Cox and Ireland, 2001; Ireland, 2004; Cox et al., 2002; Cox et al., 2004; Smits and Kuo, 2003), to study the impact of regulation on buyer and supplier power (Sanderson, 2001), to look at the lock-in effect (Lonsdale, 2001) and to explore the strategic implications of power structures (Sanderson, 2004). The extended network of dyadic power relationships is called power regimes. Watson (2001) finds that supply chains become fragmented in the presence of certain power regime patterns that causes integrative SCM initiatives to fail. Supply chain fragmentation happens in the presence of independent power structures and when an SC member is sandwiched between buyer- and supplier dominance structures. At these points supply networks break down to numerous power sub-regimes. Mutually beneficial coincidences of interests are less likely to be sustained over time between sub-regimes and without sufficient leverage, integrative efforts cannot be enforced either.

The power perspective has the potential to help explaining supply chain integration and IOS diffusion across entire supply networks. By applying it to IOS adoption and removing the adoption bias we hope to increase our understanding to the IOS adoption phenomena.

3.5 COMMENTS ON THE IOS LITERATURE

Based on our review, let us offer our comments on how the concept of power is handled in IOS research:

1. Detail in operationalization: There is a lack of adequate detail in the operationalization of power and dependence. A study that does not detail the construct of power sufficiently risks to miss important insights to the subject that eventually compromise the results of the analysis. Dependence of one organization on the other (A on B) is a function of the utility of B for A and the scarcity of B. Scarcity is low when substitutability is high, meaning that there is a large pool of firms with a similar resource that A needs, which are accessible due to low switching cost. Switching cost increases with search cost and with the presence of relation specific investments. See section 4.3.4.5 for more detail on the operationalization of dependence and the sources of power.
2. Consistency in operationalization: Articles are not only inadequately collecting data on dependence, but they are also inconsistent in how they do it. There are a variety of approaches to operationalize power. Until there is a unified, well-accepted operationalization, research results regarding power are quite incommensurable.
3. Buyer-supplier distinction: Vlosky et al., (1994) notes that the motives of suppliers and buyers to adopt EDI are different. This distinction between the role of buyer and supplier in a dyadic exchange has already been emphasized regarding type II conflict. There we mentioned the differing core characteristics associated with the two roles that constitute the architectures of supply and demand. Utility and scarcity measures are therefore not the same for buyer and supplier (Cox et al., 2002). Although resource dependence theory is dyadic, empirical tests of constraint absorption have largely focused on the dependence of one actor on the other without considering reciprocal dependency (Casciaro and Piskorski, 2005). Studies in IOS must keep this in mind when measuring dependence, especially in large-scale surveys.
4. Dyadic view: Power is a property of the social relationship; it is not an attribute of the actor (Emerson, 1962). Together with the need to distinguish buyer and supplier dependence this means that a dyadic view would be more appropriate in studying power relations. In IOS adoption we actually study co-adoption, because at least two parties need to adopt the system, before it can be used. There is a need for more meso level studies that address IOS adoption in a dyadic way. Power is not absolute, but relative, meaning that the power relation could differ with each dyadic relationship a firm is part of. Firm size for example is not a good proxy for power; even a large company could depend on a smaller one given that it has a high utility and scarce resource.
5. Dominance oriented view on power: Most of the IOS literature tends to acknowledge the role of power only in the cases of buyer dominance or supplier dominance. In these relations power asymmetry exists and the role of power considered being a pressure towards adoption. However, the dyadic

approach to resource dependence yields two distinct dimensions in a dyad: power imbalance and mutual dependence (Casciaro and Piskorski, 2005).

Power imbalance captures the difference in the power of each actor over the other. Mutual dependence measures the existence of mutual dependencies, regardless of whether the two actors' dependencies are balanced or imbalanced. Dominance situations are characterized by high power imbalance. When power imbalance is low, combined with mutual dependence we get two more scenarios: high mutual dependence shows an interdependence between buyer and supplier, while low mutual dependence results in an independent relationship. These additional power structures give a more complete view on the role of power in IOS adoption.

6. Unidirectional vs Bidirectional view on power: While the external pressure construct shows perfectly the scenario where a powerful member of a supply chain coerces or persuades its trading partners to use a particular IOS, it fails to address the inhibiting effects attributed to conflicting interests listed in Table 3-1. Firms act rational when they decide not to adopt a certain IOS (Bouchard, 1993) and non-adoption should not be viewed as a failure. We therefore propose to abandon the unidirectional treatment of power in order to remove the so-called adoption bias from the research field. A bidirectional view by which power do not only play a role as an enabler to IOS adoption, but also as a barrier, would help to explain the phenomena to a greater extent.

   Wells et al. (2001) has already tackled the idea of power being a barrier in their study of interorganizational resistance to adoption. Their work gives more support to the idea that in fact we need to dismantle the well accepted model of Iacovou et al. (1995) and separate the *intention* of a company to adopt a system from its actual *ability* to carry out its decision. A powerful company can easily refuse to adopt an IOS, which is not in its interest. Current models of IOS adoption are unable to show this scenario and therefore miss out an important factor that explain dyadic IOR and supply-network wide diffusion of IS.

7. Overreliance on the car industry: A possible reason why the adoption bias permeates the field is the frequent citing of the car manufacturing industry when power is introduced to the discussion. This industry was one of the early adopters of EDI technology and therefore fueled many case studies and quantitative research at the beginning of the IOS field. The use of coercive power by powerful companies in the automotive industry to force suppliers to adopt EDI has been widely cited (Meier, 1995; Webster, 1995; Premkumar and Ramamurthy, 1995; Gregor and Johnston, 2001; Kurokawa and Manabe, 2002).

   Industries however differ. The power regime of the automotive industry is structured around extended networks of buyer dominance and buyer-supplier interdependence (Cox, 2001). These regimes support SCI and EDI adoption as a part of it. Cox (2004a) observes that the high volume and highly standardised demand and supply circumstances in the car industry are not replicated in all other types of industries. The car industry has also demonstrated a preference toward an adversarial approach in its supplier management. Other industries can have different structural attributes and a

more collaborative approach in their relationships. This means that making generalizations based on one industry with quite specific characteristics could potentially introduce a bias in later studies. IOS adoption research should extend its scope to numerous other industries, which are structured differently and have more complex power regimes.

3.6 SUMMARY

In this chapter we provided a detailed overview of a number of research fields, which are related to this study. The chapter started with a very broad view on interorganizational relationships, but the focus was gradually narrowed down to the topic of interorganizational information systems. This approach helped us in positioning the study in the existing research areas and in defining the boundaries of the research.

As a result of the review we identified a few shortcomings in the IOS literature. In the next chapter we are introducing a new model on IOS adoption, which tries to address these issues.

Chapter 4

Research Model

Having reviewed the literature on IOS and adoption we were able to identify areas, which could be subject to improvement. In this chapter we are going to build upon past literature while we bring in new ideas in order to bridge these gaps. The main goal of this chapter is to introduce and describe in detail our research model, which we call the Adoption Position model. We begin by explaining our motivation to develop the model and the reasons we think this model is a useful addition to the existing body of knowledge. IOS adoption and power issues have been studied from various perspectives using different approaches, therefore we need to explicitly address the underlying assumptions and the basic views of our model. The next section positions our research in the field and thereby lets us relate our model to other existing ones. This section is followed by the introduction of the research model. The explanation of the logic and the idea behind the model is followed by an in-depth description of the constructs, including definitions and operationalization.

4.1 MOTIVATION

The IOS adoption literature already provides many validated models and constructs that we can use to understand the adoption and diffusion of cross organizational information systems. Therefore we think that to start theory building anew is unnecessary and would be an inefficient endeavour. Although we challenge some of the fundamental assumptions and approaches in IOS research, we still try to find a solution by refining existing theoretical models and reusing validated constructs where possible.

Currently the literature is dominated by studies that look at adoption from a single company perspective, where trading partner variables are regarded as external factors to the phenomena. IOS however requires at least two organizations to agree on the communication standards and the use of the term co-adoption becomes more appropriate. Companies are also part of several supply networks at the same time, which might require them to adopt various IOS standards and associated business processes. Adopting numerous systems for similar communication purposes could not be in the best interest of supply chain members. Socio-political factors, like trust and power become additional influencing forces that come in to play an important role in the eventual diffusion and co-adoption of IOS standards.

At the end of the previous chapter we derived some conclusions from the literature review. These comments point out weaknesses of IOS adoption research and indicate areas for improvement.

In chapter 3 we came to the conclusion that

1. IOS research needs to move toward a dyadic view, because it is the dyadic relationships that form the building blocks of networks. Dyads also represent the unit of analysis of the co-adoption of bilateral IOS. Moving away from a single company focus, we can learn more about what happens within the relationship that affect adoption by also involving the trading partner in the analysis.
2. IOS research needs to rethink the role of power in IOS adoption. The presence of the well-known and acknowledged adoption bias reduces the role of power to various external pressures that lead to adoption. This view effectively conceals another effect, when power acts as a barrier toward adoption. In other words, IOS proposals can get accepted, because of the use of power by a more powerful player in the supply chain, but IOS adoption can also fail due to the lack of interest of a powerful party. Power use is associated with situations when less powerful companies show reluctance or resistance toward an IOS investment. In these cases a persuasive or coercive application of one's dominance could prevail. However, when a dominant partner is faced with a non-beneficial IOS adoption proposal, the situation likely results in an unfavourable decision from the initiator's point of view. Having no leverage on the dominant partner, IOS adoption fails. Current IOS adoption models are unable to capture this effect.
3. IOS research needs to be more detailed and consistent on the operationalization of power. We have shown that the current operationalization varies to a great extent from article to article. Power is relative and can change by each dyad a company is part of. We also need to move away from a dominance-oriented thinking, which does not acknowledge the role of power when dependencies are balanced. Interdependence and independence are two valid power structures next to supplier or buyer dominance and should be included in power analyses.

Based on these observations we developed our model to offer a solution for these weaknesses and thereby to improve our understanding of the IOS adoption phenomena.

4.2 POSITIONING THE MODEL

Before we begin describing our conceptual model we need to set the basic assumption and to position the research in the current stream of literature. By doing this we can frame the research, define its boundaries that will also help us relate it to other studies in the field.

We take a positivist stance in our research. Although the adoption of IOS is a complex organizational problem, we believe that it can be broken down into measurable constructs where causalities can be established. Since we are trying to introduce a new way of thinking into IOS adoption we need to focus on one-way effects between the constructs in order to establish our basic model first. We therefore chose to formulate a factorial model instead of a processual one, which on the other hand emphasizes

two-way interactions and preferably the use of interpretative research philosophy (Kurnia and Johnston, 2000).

We restrict our research to the study of IOS adoption in the context of supply networks and to the dyadic relationships that form the building blocks of these networks. Trading partner relationships bear different dependency- and IOS evaluation characteristics due to the transactional nature of the relationship. To extend the focus to other, non-supply chain related IOS activities would require a higher level of abstraction of the variables involved to be able to preserve generalizability. Our goal however is to refine the view on IOS adoption in this particular area with its specific, well-defined problems that do not apply outside of these boundaries.

We assume bounded rationality for the actors that restrict their ability to ex ante assess the true benefits, costs and risks of an IOS project. This assumption allows us to use perceptual measures of decision makers, which gives us a more realistic view on the decision making itself. According to this view it is not the actual qualities of the IOS that will be taken into account in the adoption decision, but rather the qualities and costs perceived by the management. We further assume profit oriented behaviour and the presence of type I and type II conflicts in the supply network (see section 3.4.1).

Instead of concentrating on a single firm we look at what is happening on the dyadic level to understand co-adoption. Using the classification of Damsgaard and Lyytinen (1998) for levels of analysis we can position this study on the meso level. Meso level analysis concentrate on networks of interacting agents usually using strategy analysis and power dependency analysis. This level is necessary to cater for the inter-organizational nature of IOS and proved to be an effective method to gain further understanding on the topic (Ireland and Webb, 2007; Ke et al., 2009; Boonstra and de Vries, 2005)

Our model does not include directly the measurement of network effects on the macro level. Government- or industry group IOS initiatives are therefore not in the scope of the model, because we are specifically interested in explaining dyadic level mechanisms. In situations for example, when the rest of the industry has already been using a certain IOS standard, companies might be subject to mimetic pressure (DiMaggio and Powell, 1983). An organization will imitate the actions of other structurally equivalent organizations because those organizations occupy a similar economic network position in the same industry and, thus, share similar goals, produce similar commodities, share similar customers and suppliers, and experience similar constraints (Burt, 1987). Such pressure does not translate directly into our model, since it is not part of the meso level where we look at direct links. Implicitly however it can be captured by the perceived benefits construct; a firm perceives that the new IOS will bring more benefits, because the rest of the industry has used it and because it will likely emerge as the dominant communication form.

Lastly, we would like to refer back to section 3.4.2 where we discussed the various approaches to study power in information systems. According to the classification of Jasperson et al., (2002) we employ an *organizational pluralist lens* on power. On one hand it is the organizational technology lens, because power and dependence represented as independent variables in our model where we look at how power and political action influences the adoption of IT. Although IOS systems have been shown for their capacity to change dependencies ex post, we do not include a bidirectional

relation between power and adoption at this point. The research model predicts an adoption decision occurring in one time-step and the creation of a multiple-step, dynamic model with reciprocal relations is not the goal of this research. The variable "perceived risk of ex post dependency" tries to capture these future implications of the adoption on dependence in order to determine intention (see section 4.3.4.3).

On the other hand, we chose to use the pluralist power lens, because it conceptualizes power as an objective reality. Participants are assumed to have potentially conflicting interests and this perspective defines power in terms of the actors' ability to influence others' behavior. These assumptions and definitions are in line with our research.

4.3 THE ADOPTION POSITION MODEL

After having positioned our research we begin with the description of the model. First we introduce the adoption position matrix that represents the attainable combinations of intention to adopt and relative power of a firm. The conceptual model describes the constructs and the relations between the constructs that lead to the adoption positions. We continue by describing how to apply the model in a dyadic context from where we derive our propositions. A detailed description of the constructs and variables closes the section.

4.3.1 Introduction to the research model

In this section we are going to introduce and describe the conceptual model developed for this research. We chose the influential model described in Iacovou et al.(1995) as the basis from which we evolve our model. One of the fundamental distinctions is the division of intention to adopt construct from the external pressure variable. From our point of view, intention reflects the motivation of an actor, which is an internally established optimal position. Environmental forces, external influences such as various forms of pressures can then shape that intention. A rational decision maker weighs the costs, risks, direct/indirect benefits of a project and forms his own intent to adopt or not to adopt an IOS. Once the actor's view is established, environmental forces can be considered as well that might shape the decision. If both parties in a dyadic exchange relationship have a positive intention towards adoption, then they can readily proceed with the implementation of the proposed IOS without any further conflict on the adoption decision itself. External pressure becomes a notable driving force only when an actor negatively evaluated the proposal internally. Power is used in these cases by a more powerful organization to leverage the other company's dependency and influence its behavior to comply with the dominant party's intention.

At this point we can see that intention to adopt and relationship specific factors, like power structures are distinct concepts and they should be separated. In other words we need to distinguish intention from the actual ability of the firm to realize those intentions. This ability is bidirectional, which means that when a firm wants to implement an IOS, then he can also make its trading partner to do so; and when it has no intention adopting one initiated by its trading partner then it can willfully express its disagreement *and* cannot be forced into adoption at the same time.

4.3.2 The Adoption Position Matrix

Given this view on intention to adopt and on power structures within the relationship we can draw a matrix where each cell represents the combination of these dimensions for one firm in a dyadic relationship. Each cell describes the "position" of the company regarding an IOS proposal before the actual adoption decision. Therefore we call this matrix the Adoption Position Matrix (see Figure 4-1). We take the simplest representation of the adoption positions where both dimensions are binary. Companies can be categorized into having intention or not having intention in an IOS; similarly we can evaluate their relative power structure by looking at whether the focal firm has power over its trading partner or not. A more detailed description of these constructs will follow after the introduction of the Adoption Position Matrix.

	Does the focal firm have power over its partner?	
	YES	NO
Intent to adopt	**Enabling**	**Willing**
NO Intent to adopt	**Inhibiting**	**Exposed**

Figure 4-1: The Adoption Position Matrix

There are four possible adoption positions a company can be categorized into based on its intention to adopt and its relative power to its partner. An *Enabling* firm is interested in the adoption and has influence over its trading partner, therefore even when the other one is resistant it can use its power in different ways to *try* to make the implementation come true. Note that being in an enabling position does not guarantee that the IOS adoption will occur; instead it only gives the possibility for the firm to try starting the project.

A firm that is interested in the adoption of a certain IOS, but has no power over its trading partner is termed as being in a *Willing* adoption position. The Willing firm perceives a net positive return on the investment and is willing to share information through the intended electronic linkage, but it is not able to force its trading partner into the adoption. A firm with an *Inhibiting* position sees no interest in implementing and using the proposed IOS and it has the power to create a barrier to adoption. Those firms that fall into the last quadrant are less fortunate; they see no interest in the adoption and they have no leverage over the trading partner, therefore they are dependent on the other's position. Their adoption position is called *Exposed*.

4.3.3 The conceptual model

Adoption Position is thus an intermediate state with which we can describe a company that is faced with an adoption decision. This variable combines both the intention to adopt construct and the relative power of the firm. These constructs must be accurately operationalized and measured in order to be able to derive valid evaluations for the adoption positions.

The intention of a company to adopt an IOS is not only a function of the direct and indirect benefits the system can offer (O'Callaghan and Turner, 1995; Jones and Beatty, 1998; Chwelos et al., 2001) but also of the perceived costs and the perceived risks (Kumar and Dissel, 1996) of an IOS project. The relative power of the focal company is based on its dependence on the trading partner and the trading partner's dependence on the focal company. These constructs form the conceptual model as can be seen on Figure 4-2.

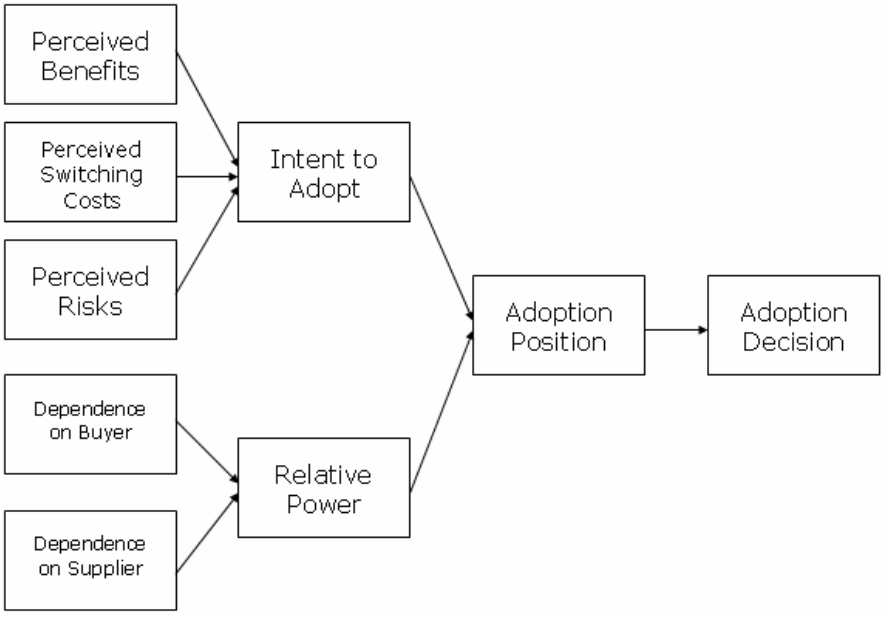

Figure 4-2: The conceptual model

The main advantage of the model is that it takes into account both the economic and social factors of the decision-making and by doing this it becomes possible to separate the intention of adoption from the actual ability of the firm to control that decision. Furthermore it is an analytical and predictive tool for IOS adoption with which we can map an entire supply network by repeatedly analyzing the dyadic relationships within it and identify not only the points of fragmentation, but also the reasons of adoption failure. In section 4.4 we talk about how the model is used in supply chain mapping in more detail.

Table 4-1 presents the definition for each construct in the conceptual model and for a few supporting terms.

Term	Definition
Adoption	A decision is reached to invest resources necessary to accommodate the implementation effort (Cooper and Zmud, 1990)
Adoption decision	Dichotomous decision of trading partners to co-adopt an IOS or not.
Adoption position	A classification of an organization in the IOS decision-making process as a function of its intent to adopt and its relative power over its set of trading partner(s) with whom the IOS is intended to be implemented in a dyadic exchange relationship.
Power	The capability of a firm to exert influence on another firm to act in a prescribed manner. (Hart and Saunders, 1997).
Dependence on buyer	The extent to which a buyer in a dyadic exchange relationship has power over a set of supplier(s).
Dependence on supplier	The extent to which a supplier in a dyadic exchange relationship has power over a set of buyer(s).
Set of buyers	The number of buyers that has a common negotiation interface with the focal organization. Usually this is one buyer. It can be more in case of the existence of a horizontal alliance or cartel. A set is viewed as one entity, creating a virtual dyadic relationship.
Set of suppliers	The number of suppliers that has a common negotiation interface with the focal organization. Usually this is one supplier. It can be more in case of the existence of a horizontal alliance or cartel. A set is viewed as one entity, creating a virtual dyadic relationship.
Perceived benefits	The anticipated advantages that the IOS can provide for the organization. (Chwelos et al., 2001)
Perceived switching costs	The anticipated costs of accommodating a new IOS into the current IT infrastructure and business processes.
Perceived risks	The anticipated exposure to ex post hazards, uncertainties and opportunism after adopting the new IOS in the focal company.
Intent to adopt	The intention of an organization to implement an interorganizational information system after the assessment of its perceived benefits, costs and risks.
Initiator	The organization, which proposes the implementation of an interorganizational information system to establish an electronic linkage with one or more of its trading partner(s).

Table 4-1: Constructs and definitions of the Adoption Position model

The unit of analysis of this study is an IOS proposal within a dyadic trading relationship. We are talking about an IOS proposal, because the focus is on the ex ante evaluation of an IOS, before the adoption decision is made. At this time the IOS only exists within the dyadic relationship in the form of a proposal from the initiator.

Taking the proposal as the unit of analysis also allows us to 1) distinguish and measure two or more IOS initiatives within one dyadic relationship and to 2) follow the process of decision making as proposals are being negotiated in case the first attempt did not result in co-adoption. By taking "snapshots" of the adoption positions through time during an IOS negotiation process we can follow how the various factors have been changed to reach adoption or which factors remained unchanged in the case of an unsuccessful IOS initiative. Therefore we can observe a certain degree of dynamism in the adoption of IOS when the model is applied longitudinally with several "snapshots", depending on the frequency of these measurements and the longevity of the negotiation phase.

We have stated before that the unit of analysis resides on the meso level, however we have not yet introduced the dyadic nature of the model. An Adoption Position is a temporary state of an organization within a dyadic relationship. Since the construct is strongly tied to the IOS proposal with a specific trading partner and to the power structure between them, it cannot be taken out from the dyadic context. It is also temporary, because it changes by each IOS proposal and when power balance shifts between the two companies. However it still describes a single company in relation with its immediate "environment", be it its customer or supplier. Having determined the adoption position of one firm is necessary, but not sufficient information to be able to make the prediction of the outcome of the adoption decision possible.

This is because the power construct only tells us to what extent the focal company has power over the partner organization and does not measure power imbalance. Next to the two cases where one of the partners dominates (supplier dominance [A>B] or buyer dominance [A<B]), the parties involved can be also interdependent [A=B] or independent [A0B]. Knowing that a buyer has power is still not enough information to decide whether it is a case of buyer dominance or rather interdependence. This method therefore necessitates the analysis of dependence from both sides of the dyad.

To get a truly dyadic view we do not only need to capture bidirectional dependence, but the Adoption Position of *both* firms involved in the trading relationship. As a result we get to know the intentions and motives for both company A and B and their relative dependence on each other as well. Mutual high dependence means high power levels for both companies, where they both own valuable and critical resources for each other, eventually bonding in an interdependent power structure. Similarly, low dependence with no power imbalance means an independent relation.

By combining the Adoption Positions of both firms in a dyadic relationship we get 16 possible combinations on the position of the supplier and the buyer (see Table 4-2). This typology is addressed in a pair-wise way, such as Enabling-Willing or Inhibiting-Enabling where the words signify the adoption position of the supplier and the buyer, respectively. These typologies serve as the basis for our propositions.

		Buyer's adoption position			
		Enabling	**Willing**	**Inhibiting**	**Exposed**
Supplier's adoption position	**Enabling**	**+**	**+**	**+/–**	**+**
	Willing	**+**	**+**	**–**	**?**
	Inhibiting	**+/–**	**–**	**–**	**–**
	Exposed	**+**	**?**	**–**	**–**

Table 4-2: Propositions of the Adoption Position Model

At the intersection of each combination is a proposition for the success of the IOS adoption. A "+" sign means that the particular adoption position pair will hypothetically support the adoption, while a "–" marked pair does not. In the case of "+/–" the interdependent parties have opposing intentions and the decision is not straightforward. Both parties highly depend on each other, but one shows intention in adopting the IOS, while the other does not. In such a situation the model is unable to predict the outcome since power does not give enough leverage to either parties. A further exploration of a number of such cases could help to deduct a general decision outcome or to uncover other factors that play an important role in the adoption decision. The "?" sign refers to the equivalently ambiguous outcome of the decision when the parties have opposing intention, but neither has the leverage to influence the other.

There are four combinations out of the 16, which are non-attainable: Inhibiting-Inhibiting, Inhibiting-Exposed, Exposed-Inhibiting and Exposed-Exposed. The explanation to this is rather straightforward. These cells represent those combinations when none of the parties are interested in an IOS regardless of their power relation. When neither of the parties in a dyad is interested in implementing an electronic communication link then there is simply no IOS proposal and the unit of analysis does not exist.

We are going to use the abbreviations listed in Table 4-3 to refer to the various relationship categories.

Adoption Position	Abbreviation
Enabling	En
Willing	Will
Inhibiting	Inh
Exposed	Exp

Table 4-3: Abbreviations for adoption positions

4.3.4 Constructs and variables

This section contains a detailed description of all the constructs and variables used in the conceptual model. The variables are measured on a 7-point Likert scale, except for a few continuous variables (e.g. supplier pool) and dichotomous variables (adoption decision, intent to adopt, commercial importance). Appendix I lists a detailed, item level operationalization, where the variable type is noted next to each item.

4.3.4.1 Perceived Benefits of IOS Adoption

Perceived benefits refer to the anticipated advantages that an IOS can provide the organization (Chwelos et al., 2001). This construct has been consistently identified as one of the most critical adoption factors and has been used extensively by various EDI adoption studies (O'Callaghan et al., 1992; Banerjee and Golhar, 1994; Iacovou et al., 1995; Premkumar and Ramamurthy, 1995). Jones and Beatty (1998) provide an assessment on the validity and reliability of the items most commonly used for measurement in order to offer a valid and reliable set of scales from the broad and sometimes inconsistent application of the construct.

The perceived benefits construct has been used extensively in previous research. Iacovou et al. (1995) found a positive relationship between perceived benefits and adoption. In five out of seven cases, perceived benefits were congruent with the adoption decision. The findings of Chwelos et al. (2001) also show a significant positive relationship with intent to EDI adoption.

Construct	**Variables level 1**	**Variables level 2**	**Definition**
Perceived Benefits			The anticipated advantages that the IOS can provide for the organization.
	Direct		Tangible items of perceived benefits
		Reduced transaction costs	The extent to which the IOS decreases the coordination- and execution cost of each transaction. Time- and cost savings directly attributable to the electronic exchange and automated processing of business documents
		Improved cash flow	The extent to which the use of the IOS will lead to cash flow improvements due to reduced order cycle time and lead time.
		Reduced inventory	The extent to which the use of the IOS will reduce inventory levels due to reduced order cycle time and lead time.
	Indirect		Intangible items of perceived benefits
		Improved information flow	The extent to which the use of IOS will lead to faster and more accurate information exchange internally and externally.
		Improved internal operation	The resulting effectiveness and efficiency gains from changing internal and cross-organizational business processes in order to accommodate the IOS.
		Improved service	The extent to which service level towards customers increases due to the introduction of the electronic link.

		Improved trading partner relations	The extent to which the relationship with the co-adopting trading partners improves due to the adoption of the IOS.
		Improved competitive advantage	The extent to which the competitive position of the adopting company is perceived to improve due to the adoption of the IOS.
		Support strategic objectives	The extent to which the IOS contributes to achieving strategic goals.

Table 4-4: Variables and definitions of the perceived benefits construct

4.3.4.2 Perceived Switching Costs of IOS Adoption

As we have discussed previously in section 3.3.1 the range of IOS types varies from one-to-one EDI connections to many-to-many e-marketplaces and these all can use a variety of communication channels. The cost of implementing an IOS therefore largely depends upon the type of technology and the extent to which the IOS function is embedded in the business processes of the firm. Most firms already equip some kind of IOS system and have already laid down business processes for interfirm communication, be it fax-based document exchange or ERP-to-ERP feed. Therefore IOS researchers do not try to measure the absolute cost of setting up an IOS from scratch, but rather they use indicators such as IT readiness (Iacovou et al., 1995; Chwelos et al., 2001) and compatibility (O'Callaghan et al., 1992; Premkumar and Ramamurthy, 1995) to assess the relative costs of the IOS given the current technological and operational levels of the firm. The more mature the firm the less disruptive new technology may be because both IS and line staff are familiar with the using of the technology (Jones and Beatty, 1998).

Compatibility of an innovation with existing organizational policies, procedures, values and systems is considered to be a relevant aspect of innovation adoption (Rogers, 1995) and often has been applied in IOS adoption studies. O'Callaghan et al. (1992) distinguishes technological compatibility and operational compatibility. Compatibility is viewed here as the effort needed to bring the current technological and operational procedures to the level required by the proposed IOS. We distinguish infrastructure-, application- and business process level compatibility.

In this study we measure the cost of IOS adoption as perceived switching cost. Switching cost is defined here as the cost incurred by the organization when deciding to adopt a new IOS compared to the current technological and operational level (Nagy et al., 2004). It is a perceptual measure, because decision makers are assumed to have bounded rationality that prevents them to know the true switching costs ex ante.

Another factor that affects switching cost other then compatibility is the relation specificity of the proposed system (Ekering, 2000). High relation specific investments have little or no value outside the relationship in which it is realized and bear high sunk costs. When the introduction of change to the IT infrastructure, application portfolio and business processes is highly relation specific, the costs of the necessary investment do not benefit other dyadic relationships and therefore cannot be spread out among trading partners.

Infrastructure compatibility

Infrastructure compatibility pertains to the adjusting of existing information and communication technology (ICT) infrastructures of the organizations in order to realize a new IOS. These adjustments are aimed at the realization of a technological foundation for this IOS. Due to the fact that this foundation will often be distributed, diverse and heterogeneous in nature, achieving infrastructure compatibility can be a complicated issue. However, most organizations are now connected to the Internet, providing them an easy and inexpensive means to communicate with other organizations, reducing the costs of realizing infrastructure compatibility.

Application compatibility

Application compatibility is related to the integration of applications operating in (often) different computing environments. In enterprise application integration (EAI), the aim is to enable communication between diverse, heterogeneous applications. The issues that need to be resolved to achieve the latter, are similar to those for integrating applications from different organizations. These issues originate from the fact that applications may differ in their abilities to communicate, their representation and interpretation (semantics) of data, the manner in which they expose their functionality to others, etc.

Until recently application compatibility was achieved through the development of custom connections between applications (such as EDI). Web services offer higher scalability and flexibility by enabling standardized and platform-independent communication between applications. The advantages of this approach are apparent: 1) standardized development of application interfaces will reduce the efforts and costs associated with application integration; 2) developed application interfaces can now be re-used across multiple integrations, making application integration more efficient and flexible. As such, we expect that application compatibility will become less and less a contributor to the switching costs of an IOS.

Business process compatibility

The purpose of an IOS is to facilitate business interactions, as described in policies that define the overall flow of information between multiple enterprises, as such functioning as an agreement. However, actual realization of the agreed upon activities in the business interactions is achieved via the internal business processes of the organizations involved. It is for this reason that business process compatibility is an issue in IOSs.

Compatibility of business processes concerns the reshaping of internal organizational processes to the practice required by the new IOS. It involves redesign of process activities, reallocation of resources, redefinition of internal norms and rules, etc. However, business processes are usually of a complex and intricate nature, making the effectuation of changes a (often) painstaking endeavour.

Although several approaches have been developed that may increase the ease with which business process compatibility can be achieved (e.g. in (Curbera et al., 2002)),

business process compatibility will (for the time being) remain a serious cost factor for switching partners.

Construct	Variables level 1	Variables level 2	Definition
Perceived Switching Costs			The anticipated costs of accommodating a new IOS into the current IT infrastructure and business processes.
	Compatibility/ Readiness		Describes the IT maturity of the firm and the gap between the current and the required technological/operational level.
		Infrastructure compatibility	The extent to which the IT infrastructure necessary for the IOS is similar to the current infrastructure.
		Application compatibility	The extent to which the applications and configurations necessary for the IOS are similar to the current application portfolio.
		Business process compatibility	The extent to which the current business processes are similar to the business processes necessary to accommodate the new IOS.
	Relation specificity of change		The extent to which the investments made to accommodate the new IOS can be used with other trading partners.
		Infrastructure specificity	The degree to which the IT infrastructure running the IOS in a dyadic relationship can be reused with other trading partners.
		Application specificity	The degree to which the internal applications necessary for the IOS can be used with other trading partners.
		Business process specificity	The degree to which critical business processes of one firm are specific to the requirements of the other firm in an interorganizational relationships.(Subramani and Venkatraman, 2003)
	Training		The extent to which the company need to train its employees to the use of the new IOS.

Table 4-5: Variables and definitions of the perceived switching cost construct

Relationship specificity of change

It is much more attractive for a company to set up an electronic communication infrastructure if it can use it with other trading partners as well. The more standards it needs to implement in-house to exchange data with suppliers and buyers, the more complex and potentially more problematic it gets to handle data and convert them into the right format. When a company is faced to adopt a proprietary standard of the trading partner, it needs to make dedicated investments into its IT systems and likely into its workflow. Dedicated investments are less desirable since they last as long as the relationship with the trading partner and the investment is not reusable compared to standard EDI or XML-based packaged solutions that need to be implemented only once. Therefore the more specific the investment needed to accommodate the new IOS proposal the more costly it becomes for the focal company to implement the changes needed since it cannot spread the cost on several dyadic relationships.

We measure the relationship specificity on three levels: infrastructure, application and business processes.

4.3.4.3 Perceived Risks of IOS Adoption

For an IOS to improve internal processes and to help the company realize both operational and strategic benefits, companies must incur several costs, including the development of the necessary IT applications, implementation expertise and often business process reengineering. Interorganizational systems projects also carry more risk than traditional, internal IT projects (Riggins and Mukhopadhyay, 1999). Specifically with IOS projects there is less control due to the uncertainty of external and possible recalcitrant trading partner actions.

One justification for IOS adoption is to smooth links in the supply chain, eliminating supply uncertainties and reducing risk (Kumar and Dissel, 1996). According to Hughes et al. (2004) IOS engender a risk paradox, in that mitigating identified risks may involve increased exposure to new risks. The perceived risks of IOS adoption refer to potential weaknesses, barriers and losses faced by organizations that adopt IOS. Such risks are transaction risk (Clemons et al., 1993), trading partner opportunism, loss of resource control (Kumar and Dissel, 1996) and post-contractual dependence (Lonsdale, 2001; Webster, 1995).

Construct	Variables	Definition
Perceived Risks		The anticipated exposure to ex post hazards, uncertainties and opportunism after adopting the new IOS in the focal company.
	Information asymmetry risk	The extent to which monitoring the trading partner's compliance and performance to the contractual terms is difficult.
	Loss of resource control risk	Fear of losing control over some resources, information or know how due to the implementation of the IOS.
	Post-contractual dependence	The extent to which the dependence of the focal company will increase on the trading partner due to the adoption of IOS. Also called the lock-in effect.
	Relation specific asset risk	The extent to which the IOS cannot be used with other trading partners in the future.
	Relation specific process risk	The extent to which the processes developed for the IOS cannot be used with other trading partners in the future.
	Risk of opportunism	The degree to which the trading partner in expected to behave opportunistically.
	Technology risk	The perceived risk of investing in a technology that will become obsolete in the future.
	Use of sub-optimal practices	The degree to which the company fears that its processes will need to be changed in a non-optimal way due to the IOS.

Table 4-6: Variables and definitions of the perceived risk construct

It is important to note that while trust as a concept is not explicitly modeled in our research model, fear of opportunism and transaction risk implicitly provide indicators of the trust level in a dyadic relationship. Trust has been identified before as an important factor to IOS adoption (Hart and Saunders, 1997) and interorganizational trust refers to the extent to which organizational members have a collectively held trust orientation towards the partner firm (Zaheer et al., 1998). Our model reflects trust issues reciprocally by measuring perceived risks of the IOS adoption. Risks encompass a large spectrum of possible uncertainties that can affect intention to adopt of which trading partner risks cover only a subset of those uncertainties. The inclusion of non-partner related risks, such as technology risk enables us to capture more diverse data and to have a broader view on the perceived risks that a company can face.

Trust and power are not two mutually exclusive properties of interorganizational relationships, but complementary and opposing components of social behavior. The complementary nature of trust and power extends from the ability of one to substitute for the other when one fails to achieve the desired results (Ireland and Webb, 2007). We have to emphasize the distinction between types of trust as it poses some constraints on this view. Contractual trust entails a mutual understanding by partners to adhere to a specified agreement; competence trust stems from the belief that the partner organization has the required managerial and technical capabilities to perform a given set of tasks; and goodwill trust that exists when partners are willing to act in ways exceeding stipulated contractual agreements (Sako, 1992). While coercive power and goodwill trust do not exist simultaneously in relationships, competence and contractual may concurrently exist. Goodwill trust may coexist in the presence of non-coercive forms of power (Ireland and Webb, 2007). Such trust can mitigate the risk of trading partner opportunism or loss of resource control.

4.3.4.4 Intent to Adopt

Intent to adopt is the dependent variable used by various studies (Iacovou et al., 1995; Chwelos et al., 2001) to establish the intention of a company to adopt EDI. The dependent variable “adoption” has been operationalized in different ways throughout the IOS literature (Somasundaram and Rose, 2003): adoption decision (Saunders and Clark, 1992), extent of adoption (Drury and Farhoomand, 1996), critical success factors (Cavaye and Cragg, 1995).

The intent to adopt an IOS is interpreted slightly differently than in previous studies. It measures the intention of an organization to implement an interorganizational information system after the assessment of its perceived benefits, costs and risks. External driving forces, such as external pressure is not present in the variable. In order to be able to derive valid adoption position values from the intention variable we chose to create it as a binary variable. We need to use a binary representation, because the adoption position is a categorical- and not a continuous variable. After careful evaluation, respondents can express their positive or negative intention about a very specific IOS proposal with a given trading partner. This way we get a purely internal perception of the company’s intention, which is later compared with its ability to carry out its intentions relative to the trading partner.

4.3.4.5 Relative Power

The relative power between a supplier and a buyer are measured by the extent of the mutuality of each other's dependence on each other. In order to be able to distinguish dominant power situations from interdependence and independence, we need to measure both the supplier dependence (on the buyer) and the buyer dependence (on the supplier). Since the role of buyer and supplier in a dyadic relationship are quite distinct, power sources and causes of dependence are different for both as well.

In section 3.4.4 we have already covered the various operationalization of the concept of power in the IOS adoption literature. In our research we follow the ideas laid down by Emerson (1962), Pfeffer and Salancik (1978) and Cox et al. (2002). According to them, power is the ability of a firm to own and control critical assets in markets and supply chains and thereby influencing others' behaviour or direct value distribution. Critical assets are supply chain resources that combine high utility with relative scarcity in a buyer-supplier exchange and in a market context (Cox et al., 2002). If a resource owned by the buyer in the dyad is valuable and relatively scarce for the supplier, it creates dependency for the supplier on the buyer.

We would like to make two notes here. First, the switching cost variable contained by the dependence construct is different from the perceived switching cost construct described in section 4.3.4.2. This switching cost refers to the costs of switching trading partners, while the latter measures the costs of changing internal IT systems and processes to accommodate the new IOS. Second, the presence of cartels or informal alliances between competitors might force companies to engage in collective bargaining with many trading partners at the same time. Such agreements between competitors might allow them to develop a larger power base collectively then they would have individually. In this case it might happen that the focal firm needs to negotiate and co-adopt the IOS with more than one trading partner at the same time. In order to accommodate this situation we included the term "set of suppliers/buyers" in our definitions of dependences in Table 4-1. Once a cartel is present on one side of a dyad, the allied firms are grouped together for the sake of our model and are treated as one entity. In this way we form a "virtual dyad" and treat the homogenous relationships as one.

Table 4-7 lists the detailed operationalization of the dependence on supplier construct.

Construct	**Variables level 1**	**Variables level 2**	**Definition**
Resource utility			The degree of operational and commercial importance of a good or service for the buyer's supply offering
	Operational importance		The degree to which a particular resource is indispensable to the provision of the firm's supply offering.
		Indispensable resource	The criticality of a procured product or service for the buyer's own product offering.
		Volume of purchases	Volume of the buyer's spend in a particular resource relative to its total purchasing budget.
	Commercial importance		Whether the particular good or service is used by the buyer in a primary or a support activity and what it contributes overall to the revenue and cost profile of the company

Resource scarcity			The extent to which the particular good or service is relatively difficult to source or be substituted.
	Imitability		The degree to which the particular good or service can be copied.
		Property rights	The extent to which imitation of a good or service is protected by licenses, patents and trademarks by the legal system.
		Information impactedness	The extent to which one can discern how the product is made.
		Causal ambiguity	The complexity of the product and the extent to which causalities between its constituting parts can be established.
	Substitutability		The degree to which the particular good or service can be changed to another that provides the same or similar function.
		Supplier pool	The number of suppliers that can provide the same or similar resource.
		Differentiating value of product	The extent to which the sourced resource provides a unique input for the buyer that makes its product or service offering different from its competitors.
		Reputation of supplier	The perception of scarcity based on the reputation of the supplier.
		Buyer's switching cost	The cost of switching to another supplier to source a particular good or service.
		Buyer's search cost	The cost of searching for another supplier to source a particular good or service.
		Innovativeness	The innovativeness of the supplier creates a higher value for the buyer in that it can offer an innovative product with high resource utility
Presence of a cartel			The existence of a formal or informal agreement between suppliers to control prices and align competitive behavior.

Table 4-7: Variables and definitions of dependence on supplier construct

Table 4-8 lists the detailed operationalization of the dependence on buyer construct.

Construct	**Variables level 1**	**Variables level 2**	**Definition**
Resource utility			The degree of operational and commercial importance of the supplied good or service for the supplier.
	Operational importance		The degree to which the buyer's expenditure to the supplier is indispensable and the degree to which the supplier can streamline its operations according to the demand pattern.
		Weight of buyer	The importance of the buyer relative to the total sales. (Volume of sales / Total sales) *100
		Volume of product range	The importance of the buyer relative to the total sales in a particular product range
		Regularity	The extent to which the orders from a particular buyer are incoming in a predictable fashion.
		Frequency of sales	The time elapsed between two orders from a particular buyer (daily, weekly, monthly)
	Commercial importance		Whether the particular good or service is used by the buyer in a primary or a support activity and what it contributes overall to the revenue

			and cost profile of the company
Resource scarcity			The extent to which the particular good or service is relatively difficult to sell or it is difficult to substitute the buyer.
	Substitutability of buyer		The degree to which the buyer can be changed to another that buys the same product or service.
		Buyer pool	The number of buyers that are potential customer for the same product or service.
		Supplier's switching cost	The cost of switching to another buyer to sell a particular good or service.
		Search cost	The cost of searching for another buyer to sell a particular good or service.
		Reputation of supplier	The perception of scarcity based on the reputation of the buyer.
Presence of a cartel			The existence of a formal or informal agreement between buyers to control prices and align competitive behavior.

Table 4-8: Variables and definitions of dependence on buyer construct

4.3.4.6 Adoption Decision

We have described earlier that we make a clear distinction between the adoption decision and the intent to adopt constructs. The adoption decision is a dichotomous dependent variable that measures the co-adoption of a particular IOS proposal between a specific dyad of trading partners. Unlike most other studies that consider the adoption decision from a single company point of view we define it using a dyadic approach. Our justification for this approach is the fact that an IOS requires mutual adoption by trading partners to be truly considered a working electronic linkage (Nelson and Shaw, 2003). By not considering the mutuality and the decision of the partner organization one would disregard an essential property of an IOS.

In our model, the intent to adopt construct reflects each company's individual decision, which is then subjected to the power structure between them. This puts them into various adoption positions. The combination of the adoption positions of two dyadic trading partners projects the outcome of the adoption decision.

4.3.4.7 Control variables

Control variables are introduced into a statistical analysis to see if a statistical relationship holds among observed entities that are alike on a particular characteristic. Control variables isolate extraneous influences that might affect the relationship between the independent and dependent variables. With the use of control variables we can test the existence of alternative explanations for the studied relationship, in other words whether X is spuriously related to Y.

Based on previous literature we measure the control variables listed in Table 4-9.

Control Variable	**Definition**
Firm size	The size of the company measured by the annual revenue and by the number of employees.
Job title of respondent	Control for the position of the respondent at the company.

Technology conversion type	Refers to the extent of older IOS solutions installed in the firm (Nelson and Shaw, 2003).
Role in the supply chain	The position and function of the focal firm in the supply chain of its main activity. E.g.: manufacturer, wholesaler, retailer, transportation, etc.
Initiator	The organization, which proposes the implementation of an interorganizational information system to establish an electronic linkage with one or more of its trading partner(s). Could be the buyer or the supplier.
Time of the survey	Refers to time the survey was taken relative to the adoption decision. The respondent could be surveyed ex ante or ex post a particular IOS adoption.
Presence of a cartel	The presence of a cartel agreement between the trading partner and its competitors can have a great effect on the focal firm's dependence. This control variable is introduced to see whether the trading partners should be treated as a "set of suppliers/buyers" or independent entities.

Table 4-9: Control variables

4.4 MAPPING SUPPLY CHAINS

The Adoption Position model helps in explaining and predicting whether a particular IOS proposal will be accepted or not by dyadic trading partners. A mutual acceptance of the standards, the commitment to invest from both sides into technological and operational changes and the willingness to share information leads to the co-adoption of the IOS.

Despite the important insights that an analysis of dyadic exchange can offer, the picture outlined above remains partial. Buyers and suppliers do not operate in a vacuum and the process of bringing any good or service to market requires a network of companies to work together. In supply chain management Cox et al. (2000) and Cox et al. (2002) introduce power regime analysis to study the value distribution among supply chain members. They start with a dyadic analysis of each relationship between supplier and buyer and gradually expand their focus to the entire supply network where each dyad acts as a building block of the entire network. This analytical modeling allows them to find structural patterns within and between power regimes that helps explaining the functioning of the network.

Analogously we can apply the concept of Adoption Position to an extended network of dyadic relationships to study the diffusion patterns of various IOS standards, while still remaining on the meso level of analysis. This means that the conceptual model and the accompanying analytical thinking enable us to expand our focus to several tiers of the network and find the rationale in the diffusion of certain IOS standards over other competing ones on the SC level. These reasons will help us understand why certain parts of the chain might use different IOS than the others and can explain the emergence of certain IOS proposals on a dyadic level. Other implications of an expanded analysis beyond dyads could also be considered: why certain companies become initiators? Why certain companies achieve high integration levels with only their suppliers and not with their customers (or vice versa) (Frohlich and Westbrook, 2001)? To what extent underlying power regimes indicate a similarity to IOS diffusion patterns?

With the use of an extended adoption position analysis we can identify the critical points in a supply network where collaborative behavior is less prominent and where

the failure of IOS co-adoption undermines an otherwise promising supply chain integration initiative.

4.5 CHAPTER SUMMARY

The chapter introduced our conceptual model in detail. Section 4.1 explains our motivation for developing a new conceptual model in the IOS adoption field. In section 4.2 we set the basic assumptions for our approach, the research context and its boundaries. Finally we positioned the research using existing typologies, such as the level of analysis (Damsgaard and Lyytinen, 1998) and power lenses (Jasperson et al., 2002). Afterwards we gave a detailed introduction and description of the Adoption Position model. The research model is a descriptive model that explains the outcomes under various conditions as opposed to prescriptive models, which aim to convey the required behaviour or properties of a phenomenon.

The bulk of the chapter explains the idea behind the model, introduces the conceptual model, describes the operationalization of the constructs and defines all constructs and variables. The propositions are formulated that predict the outcome of an IOS co-adoption decision based on the intention to adopt of the trading partners and their relative power relationship. The aim of thesis is to validate the Adoption Position model and to test the propositions. We used the method of multiple case studies for data collection. The next chapter contains the description of the case studies and data analysis.

Chapter 5

Multiple Case Studies

In this chapter we aim to validate the Adoption Position model presented in the previous chapter. We conducted multiple case studies with companies from various industries to test the propositions. Following the unit of analysis, each case features an IOS adoption proposal within a dyadic exchange relationship. The case studies result in an adoption position pair for the respective firms that reflect their motivation to adopt an interorganizational information system and their power relations. The propositions are then compared to the actual adoption decision outcomes. The case study data gathering method allowed the collection of both detailed quantitative data through the use of questionnaires and in-depth qualitative data using interviews.

The chapter is structured as follows: Case studies with a common focal company on one side of the dyad are presented under the same section. Section 1 describes the cases of Trespa International. First, background information about the company, its market and its product line is presented. After this we begin the description of supplier-side cases, which are followed by the examination of customer-side dyadic relationships. The chapter continues with case studies from other industries, such as Bakkersland from the food and grocery industry and an analysis of an initiative in the Dutch insurance market.

5.1 TRESPA INTERNATIONAL

5.1.1 Specific methodology issues

An effective way to compare dyadic relationships is to keep one company among the case studies constant. By studying the relationships of this focal company with its suppliers and buyers we do not only gain economies of scale in research efforts, but also ensure that our sample dyads operate in similar environments, that they wish to employ similar IOS solutions and in general are exposed to the same external effects. This design allows a small degree of control over extraneous variables and helps us focus on the effects predicted and measured by our research model.

We have conducted 10 in-depth interviews with both business and IT managers at Trespa to understand the internal operations and information systems present at the company. Interviews with supply chain managers and with the customer relation team leader provided information on the immediate tiers in their supply network. These interviews were guided by a case study protocol.

A structured questionnaire was developed based on a review of previous studies. A methodology expert helped with the initially refinement of the survey. It was fine-tuned later by pretests during the initial interviews at the focal company to ensure the readability of the questions and that they were understood well. The questionnaire had four different versions on two dimensions: time of the survey (ex ante; ex post) and

the role of the trading partner (buyer; supplier). Timing of the survey in function of the companies' position in the decision making process was a factor where distinctions had to be made, because the questionnaire had to be written differently for cases that were about to evaluate an IOS proposal (ex ante) and for those cases, which have already made an IOS decision in the past (ex post). Difference in the role of the trading partner required the use of different measures of dependence and the rewording of some question items. The four resulting questionnaires were: (a) ex ante-buyer; (b) ex ante-supplier; (c) ex post-buyer; (d) ex post-supplier.

The appropriate questionnaires were sent out to select trading partners on both the supplier and customer side. In addition to the English version, the questionnaire was also translated into French and German. Dutch partners were considered proficient both by the methodology expert and by the focal company.

The questionnaire was not only a data gathering tool, but it also helped us screen out interesting, representative cases. We visited three of these companies, which were geographically close and have agreed to receive us in order to triangulate the survey results by interviewing IT and purchasing managers. With two suppliers we conducted the interview through the phone.

Our focal company requested the anonymity of their trading partners in all published research material. We comply this by replacing the name of the companies with a numbered label e.g.: Supplier 1, Supplier 2 or Customer 1, Customer 2, etc.

5.1.2 Background information

In our first set of multiple case studies Trespa International serves the role of the focal company. Trespa is an international company in the Netherlands that develops and manufactures high-quality panelling for façade cladding and interior applications. With 125 million euros annual revenue and 550 employees, it is one of the largest composite panel manufacturers in the world. The company is a supplier for the construction industry with its exterior applications and the furniture industry with the interior product lines. Trespa established a worldwide presence by the acquisition of local sales branches in Canada, China, Japan, UK, Belgium and Spain. Other countries are served through agencies.

The company was founded in 1960 as an independent company, but a German chemical firm, Hoescht, acquired it 3 years later. The new owner put a lot of energy and money into research and development to improve the sheet material, which had a lot of promising characteristics. After the two decades they introduced the first exterior application in 1987. Trespa was growing internationally and its products increasingly became a preference for architects. HAL (Holland American Lines) Holding acquired the company in 1996.

5.1.3 Products

Trespa manufactures high quality sheet materials. It has four product lines:

- *Athlon*: The product line is designed for a wide range of interior application. Athlon sheets are used by OEM furniture manufacturers to create tables, boards, wall cover panels, lockers, etc. The product has many desirable characteristics. It is not affected by moisture and its special surface structure

makes it highly resistant to scratches. The closed surface does not attract dirt and it can be cleaned easily even with strong disinfectants, because it is also chemically resistant. Trespa Athlon is very durable, keeps its properties for a very long time.

The Athlon sheets can be cut up into any desirable size and shape. To colour the surface, a décor paper layer is used, which can also assume various structural patterns. An infinite variety of shapes, colours and surface structures make the Athlon a very customizable product line and a favourite among interior designers for office furniture.

- *Meteon*: A similar flat panel to the Athlon, the Meteon product line is used in exterior applications, such as building façade cladding. It is extremely weather resistant and does not change shape or colour after decades of exposure to sun and rain. It retains the durability and impact resistance of the Athlon line. The colour and texture variations give a modern look to the buildings and can be considered a luxury material. The Meteon competes in the construction industry with other kind of exterior cladding materials, such as glass and brick.
- *TopLab*: A specialized product line for interior application where the sheet is exposed to highly chemical materials. TopLab is used as worktops in laboratories due to its high chemical resistance. It has also a very scratch resistant surface, which is easy to clean and maintain. Shape and colour variations makes it an ideal raw material for specialized furniture manufacturers.

The unique properties of the Trespa panels are achieved through the special production technology. The sturdy and hard sheets are made out of paper impregnated in fenol resin. This part of the product is called the core material and normally consists of 48 layers of paper. A colour layer of melamine-impregnated paper is added on top and to the bottom of the core material. These layers of paper then pressed together under high pressure (100 bar) and high temperature (160 Cº). This production process results in a compact panel. A layer called overlay is often added to increase scratch resistance. The Meteon product line is also cured with a high voltage electron beam that gives it the property to retain its original colour after years of exposure to direct sunlight and environmental effects.

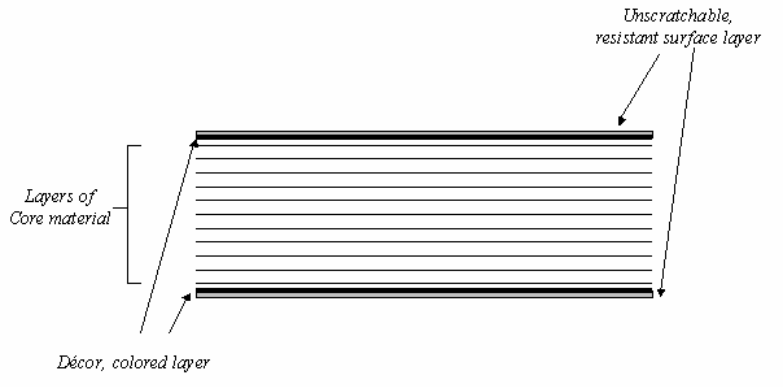

Figure 5-1: Cross section of a Trespa panel

It is important to get a glimpse at the production process of the Trespa panels in order to understand the role of the raw materials used in the production. The core material is heavily impregnated with resin, which necessitates a special, cardboard-type of paper to be used as raw material. Only two companies are able to supply the necessary quality: one from the US and one from Finland.

To decrease their reliance on these two suppliers, Trespa has started to experiment with a new core material. The new core uses wood chips grinded into fine fiber instead of the special paper. At the moment Trespa is able to cover 30% of the total core material demand with its in-house, wood chip-based substitute, however the production capacity is limited to this volume. The building of a new production line would require substantial investments and the resulting capacity would be much higher than the current demand for core materials, rendering the line underutilized. Therefore the procurement of the core material paper remains an important input for the company and a significant portion of its purchasing budget.

Coating material is from the Netherlands and Belgium, the décor papers are from companies from France and Germany. Resin suppliers are located in the Netherlands and Germany, while wood chips are transported from Belgium and Germany. Trespa panels do not need many raw materials, but those are high quality, sometimes unique products. This fact allows us to study various dependence structures on the supplier side of the focal company.

5.1.4 Supply chain management at Trespa

Due to the special inputs that Trespa needs for its production process, its supplier base is relatively small. It procures from around 60 companies worldwide, which include office- and MRO (Maintenance, Repair and Operation) suppliers as well. Approximately 600 dealers and OEMs from all over the world make up the customer pool of the focal company. OEMs are mostly furniture manufacturers and use the panel as part of tables, cabinets, hospital beds. Dealers are wholesalers to the construction industry and distribute for both internal and external applications.

The product comes in standard sizes and colours, but has a high number of customizable variables. Orders can specify custom dimensions (length, width, thickness), colours for both the lower and the upper side, surface pattern or print. The décor papers cover only the large top and bottom surface of the sheets, which means that the core material is still visible on the sides. The resin used in the production process makes it black, but even the colour of the core material can be changed when the customer requests it. Approximately 7000-8000 different items are sold each year.

The fairly standard input requirements and the highly customizable outcome allowed Trespa to design its manufacturing process in a flexible way. It implemented a hybrid or leagile production system, which is a configuration that integrates the lean and the agile manufacturing principles (see 3.2.2). Inputs are procured from the suppliers based on historical sales data and forecasts. Production starts immediately, keeping a low level of raw material inventory. The sheets are produced in standard sizes and stored without any customization. This semi-finished stock is the customer order decoupling point in the production process. Once an order from a customer arrives, the semi-finished products are taken from stock and the order-specific production

starts. The sheets are then cut up and receive their particular colour and surface pattern. Up until the decoupling point the system works as a push-system, from then it is a pull-system, therefore the semi-finished stock is also called a push-pull threshold. The hybrid solution allowed Trespa to decrease its lead time from 9-10 weeks to an average of 2.2 weeks.

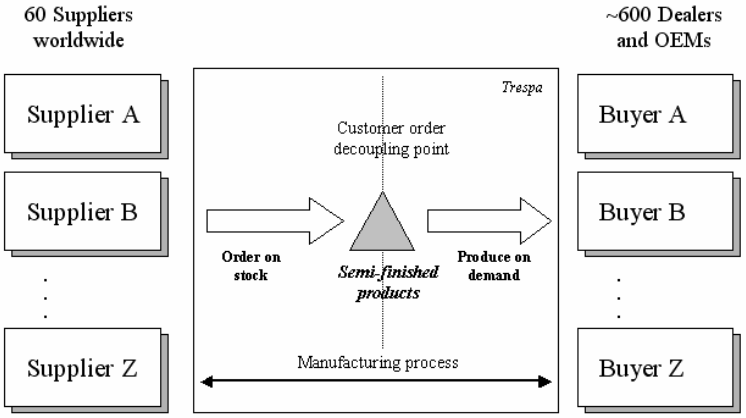

Figure 5-2: Production process at Trespa with semi-finished stock

Sourcing is divided into strategic- and MRO sourcing. Strategic sourcing involves all raw materials including paper for core material, décor paper, resin, acrylics and polyesther foam. To ensure on-time delivery, availability and low raw material stock levels at the same time, the company is using integrated planning. Forecasts are used to produce a master production plan 12 months ahead and the processes are highly optimized, resulting in a 95% reliability on the on-time delivery figure. The priorities for strategic sourcing are on-time delivery, reliability and quality. Since the raw materials are of special quality, there are only a few companies that can fulfil the requirements. In order to avoid complete dependence on these firms, which could have an adverse effect on both the pricing and on the risk of relying on a sole supplier, Trespa maintains a dual sourcing policy. This means that whenever possible they try to buy each raw material from at least two suppliers to lower the risks and not to let the supplier in a price setting, monopoly situation.

MRO sourcing entails technical suppliers who generate a large flow of goods of office supplies and maintenance parts. Procurement priorities for these suppliers are efficiency, flexibility, responsiveness and cost reduction. Non-strategic suppliers are often asked for process optimization, which also includes system integration.

5.1.5 IOS and communication standards at Trespa

Trespa started to invest heavily into information systems under the ownership of Hoescht. The German company required all its subsidiaries to implement the same ERP system to allow better connectivity through standardization to the mother company. Trespa started to install its SAP modules in 1991. Currently many modules and functions are implemented including the data warehouse, traceability, process control, financial systems, master production schedule (MPS), customer relationship management (CRM) and business connector (BC).

The company is not only innovative in its product design, but it also pioneered in supply chain integration in the construction industry. In 1997 it set up an EDI connection with Customer 1, but curiously it was not until 2000 when electronic integration started to gain the attention of the management. By that time the company was running on SAP and through the use of ERP system it became interested in further automating procurement and order processing. Currently the company generates all its purchase orders using SAP, which are formatted into four different IOS messaging standards, namely:

- EDIFACT and ANSI.X12
- SAP standard bXML (business-XML)
- xCBL (XML Common Business Library)
- standardized textfile (CSV)

These messages are then communicated to the suppliers through three different communication channels:

- HTTPs (*Secure Hyper Text Transfer Protocol*): Standard way to send bXML messages via the Business Connector of SAP. This is the preferred format for Trespa as it requires the least amount of further conversion and can plug in straight into another company's ERP system. The message is transferred according to the secure (encrypted) HTTP Internet protocol. This is a real-time data transfer solution. Currently it is used in appr. 90% of electronic transactions of Trespa.
- FTP (*File Transfer Protocol*): The generated purchase orders are stored on an FTP server, which can be either located at the site of the focal company or at the trading company's. The recipient accesses the FTP server regularly and downloads the purchase orders. This is a batch system where transactions are not transferred and processed immediately.
- Email attachment: Orders are generated as standard textfiles and sent to the supplier as an email attachment. It can be either a simple ASCII textfile or a spreadsheet file. Back-end front-end integration is not guaranteed in this case, the supplier might process the file manually, instead of letting its back-end systems process the file format.

MRO suppliers at the same time have their own order processing system and they are ahead of the construction industry in terms of supply chain integration. They usually offer an extranet access with a web-interface that allows buyers to enter the purchase orders manually in the form of e-stores or other integrated solutions. One MRO supplier developed a system based on theVendor Managed Inventory (VMI) concept. The MRO supplier keeps track of the inventory levels for the product they supply and transports additional goods according to its own replenishment policy. As the goods arrive to the Trespa warehouse their ownership is transferred to Trespa. The implementation of the VMI information system is however entirely separate from the systems of Trespa therefore we do not consider it as a valid case.

The large diversity of IOS standards required substantial investments from the focal company not only in IT infrastructure and application integration, but also in developing relationship specific business processes. Each of these message- and

communication standards discussed here are implemented on the supplier side of Trespa. Despite these efforts the company still has to maintain a manual, fax-based order processing, which results in higher processing costs and higher probability of errors in the data. The reason for this is that most of the integrated partners are suppliers and customer-side electronic integration is virtually non-existent.

Why is this asymmetry present in the degree of integration between the supplier and the customer side? Why does the Manufacturer have to deal with many different IOS standards? What are the reasons behind failures in integration attempts? We try to answer these questions by analyzing specific relationships in the Manufacturer's business network using the Adoption Position model.

5.1.6 Motivation of Trespa – Supplier side

We conducted the case studies with the aim to assess the four constructs that determine the paired adoption positions of the dyads. These are 1) the intention of the supplier to adopt a specific IOS; 2) the intention of the buyer to adopt a specific IOS; 3) the extent of dependence of the supplier on the buyer; 4) the extent of dependence of the buyer on the supplier. Our research design where we have a focal company across many dyads allows one of these constructs to be fixed. The motivation of Trespa to implement the IOS is the same for all supplier side cases as long as we keep the same IOS, which was initiated by Trespa, in focus.

This system is the SAP-based document exchange. Orders are generated within SAP in the iDoc format and sent to the Business Connector (BC). Idoc (intermediate document) is a standard data structure for electronic data interchange between applications written for SAP. The BC then converts this message to the desired external format, most of the cases to bXML. This is a robustly designed message format where a lot of fields are optional and leave much room for customizing the content. At the same time it is easily interpreted by the receiving system if it also uses an ERP-based BC.

Setting up such a system with suppliers is highly beneficial for Trespa. The automated processes leave out a lot of manual administration and paper handling therefore it scored very high on direct benefits, such as improved information quality, reduced inventory and reduction of data errors. This integrated IOS reduces the order cycle time, making the manufacturing process more flexible and responsive. Trespa perceived that indirectly it helps them improving customer service and support there strategic objectives.

This IOS is ERP-based that logically requires an ERP system in place before it can be implemented. The company has been running SAP for a few years before the IOS initiative that made the platform readily available. Cost perceptions from the IT manager and the Supply Chain Manager were similarly low both for investments in additional infrastructure and for application integration. Process redesign however required significant investments. The introduction of the IOS required changes in the procedures that caused some disruption in the workplace and it also substantially changed the way Trespa operates. Despite the high technology compatibility, the company still had to invest in business process redesign to comply the IOS requirements. These investments were not relationship specific, because Trespa can use the same IOS infrastructure and business processes with other suppliers. Deviation only occurred in a few cases on the application integration level.

In general, Trespa did not perceive the investment to be risky at all. They trusted the trading partners, the non-specificity of the investment did not carry the risk of post-adoption dependence and they were confident that the IOS would not become obsolete in the short- and medium term.

As a general rule we can assume, that the initiator always has intention to adopt; otherwise it would not initiate the IOS in the first place. This means that the initiator in our analysis always qualifies to be an Enabling or a Willing firm, depending on the power structure in the dyad.

5.1.7 Case 1: Supplier 1 – Trespa

Supplier 1 is a producer of a special carton paper that forms the core material of the product that is placed in between the surface sheets. This company has the largest share in Trespa's procurement budget. Supplier 1 is a large manufacturer of paper- and wood-based products in the US, employing more than 40.000 people. Trespa procures 75% of its core material from Supplier 1, while Supplier 2 provides the rest. This is due to its dual sourcing strategy to reduce the dependence on a single source in the case of highly specialized, strategic items.

Supplier 1 was the first company on the procurement side that established an IOS with the focal firm. They both use SAP that made the setup easier and it provided a good opportunity for Trespa as learning experience. The proposal was different from that of other supplier side company, because it did not involve a full order cycle. Supplier 1 had an ongoing practice with VMI and wished to use the same concept with Trespa. Supplier 1 was going to send batches of large paper rolls based on forecasts and not on purchase orders. Instead they would send advanced shipment notices (ASN) and the invoice afterwards.

To achieve this they set up an XML-based EDI connection using the BC module for automating order handling and to enable the system to receive ASNs. The initiative came from Trespa and it had high perceived benefits in the form of reduced inventory level, improved information quality, improved internal operations and decreased lead times. Costs were high, because this was the first time the IOS was implemented at the focal company and it also had relation specific message mapping to xCBL message format. Supplier 1 was also not ready either, because it did not use XML-based messaging, instead was still using standard EDI, more specifically ANSI.X12. However the benefits were perceived to be higher than the costs and the risks and both companies had the intention to adopt.

Trespa is clearly dependent on Supplier 1, because of the volume and scarcity of the core material. Recently it has started to experiment with using wood chips as substitutes for the core material, however the investments needed to increase capacity in this direction are prohibitive at the moment. Although Supplier 1 is a much larger company, Trespa is the largest buyer from them in Europe and ranks second when we include the US market. The regularity, frequency and predictability of orders also increase the value of the manufacturer (Cox et al., 2002). Trespa provides excellent forecasts that help Supplier 1 plan its own production schedule and replenish the customer's inventory.

In terms of power structures, this is an interdependent relationship (A=B). Both parties depend on each other and both were interested in the adoption of the IOS,

therefore the adoption position of this dyad is Enabling-Enabling. This is a supportive structure that resulted in integration and collaboration.

SUPPLIER 1					
Int. to Adopt – Supplier 1		**HIGH**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	Medium		Substitutability of buyer	Low
Perceived Switching Cost		**MEDIUM**			
	Infrastructure	Low			
	Application	Medium			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Medium			
Perceived Risk		**LOW**			
TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Supplier 1*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	High		Imitability	Medium
Perceived Switching Cost		**HIGH**		Substitutability of supplier	Low
	Infrastructure	Medium			
	Application	Medium			
	Business process	High			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	Medium			
Perceived Risk		**LOW**			
ADOPTION POSITION SUPPLIER 1 – TRESPA					
Power structure		**A=B**	Interdependent		
		Supplier 1	*Trespa*	Initiated by Trespa	
Intention to adopt		High	High		
Power over partner		High	High		
Adoption Position		**Enabling**	**Enabling**		

Table 5-1: Summary of Case 1

5.1.8 Case 2: Supplier 2 – Trespa

Supplier 2 is a paper, packaging and forest products company based in the UK with 45.000 employees, producing and selling fine papers, packaging boards and wood products all over the world. It is the secondary supplier of the core material and is a direct competitor of Supplier 1. By now almost the whole ordering cycle is done electronically, including purchase order, order response, ASN, invoice and forecast information. The difference from the previous case is that this time the supplier had more dedicated investments in the IOS adoption. For them this was a pilot project, while Trespa already had the BC ready and implemented.

One problem during integration was that Supplier 2 used the standard system of the paper industry, which was not compatible with the BC. In response Supplier 2 made some dedicated investment in the form of a gateway server, identical to the one Trespa uses. This way message transaction became straightforward, but on the supplier side they still had integrate with the back-end system by converting bXML messages to their internal PaperNet format.

Supplier 2 saw an increase in information quality and better customer service as the benefit from the adoption of the IOS. The costs of integration scored medium (3.25 out of 7) with application integration and training of the employees being the highest. As it was a pilot project for Supplier 2, the investments into the IT infrastructure (dedicated server) and application integration were high. They saw no significant risks in adopting the new system except for being more dependent on Trespa by having relation specific assets.

Both the intention and the dependence scored very similar to the previous case, except that the buyer is slightly less dependent on the supplier. Trespa sources 25% of its strategic core material from Supplier 2, which is geographically closer. The reliability and reputation of Supplier 2 makes it an important supplier for the focal company. On the other hand Trespa represents only 1.5% of total sales for supplier, however it is the main customer in its non-core business activity. Switching to another customer would not be easy, because Trespa represents a niche market for this special product. At the same time the focal company sends very reliable forecast information and frequent, predictable orders. The batch sizes and frequency of the orders are in line with Supplier 2's preference. These good customer qualities make Trespa a very important customer.

Both companies had the intention to implement the system and they also had an interdependent power structure in their dyadic relationship. According to our typology, the relationship is an Enabling-Enabling one. This resulted in extensive collaboration where Supplier 2 set up a dedicated gateway towards the manufacturer and with its help has done extra, relation specific data mapping to bXML format, which is the preferred message standard of Trespa. Case 1 and 2 have shown that in an Enabling-Enabling type of relationship, both firms collaborate and are dedicated to invest into the relationship regardless of being the supplier or the buyer.

SUPPLIER 2					
Int. to Adopt – Supplier 2		**HIGH**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	Medium		Commercial importance	High
	Indirect Benefits	High		Substitutability of buyer	Low
Perceived Switching Cost		**MEDIUM**			
	Infrastructure	Medium			
	Application	Medium			
	Business process	Low			
	Specificity Inf.	Medium			
	Specificity App.	High			
	Specificity BP.	Medium			
Perceived Risk		**LOW**			
TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Supplier 2*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	High		Imitability	Medium
Perceived Switching Cost		**LOW**		Substitutability	Low
	Infrastructure	Low			
	Application	Medium			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
ADOPTION POSITION SUPPLIER 2 – TRESPA					
Power structure		**A=B**	Interdependent		
		Supplier 2	*Trespa*	Initiated by Trespa	
Intention to adopt		High	High		
Power over partner		High	High		
Adoption Position		**Enabling**	**Enabling**		

Table 5-2: Summary of Case 2

5.1.9 Case 3: Supplier 3 – Trespa

Supplier 3 is the single source supplier of the surface material from the chemical sector. Trespa used its dual source strategy in the past until 2004, when the global supplier of specialty chemicals and materials took over the surface specialty branch of

a Belgian pharmaceutical company that produces coating chemicals, adhesives and chemicals. The acquisition resulted in the current company that we call Supplier 3. It is now the world's leading specialty chemicals and surface coating company.

Currently there is no IOS implemented between the focal company and Supplier 3. Trespa would be interested in establishing a Vendor Managed Inventory (VMI) system, however its intention has been diminished by several factors. Supplier 3 is exploiting its monopoly position by charging a high price for its product. This lowers trust towards it and raised the value of the perceived risks construct significantly. Moreover, the increase in post-adoption dependence is seen as a real threat for the focal company. Supplier 3 uses an arm's length approach and frequent management changes lowered the goodwill of its trading relation. Not to engage in single source partnership is a strategic goal for Trespa, which in turn lowers the perceived benefits construct.

Supplier 3 is also reluctant to implement VMI due to the involved costs and it sees no benefits from implementing it with Trespa. The VMI concept typically puts more responsibility and cost on the supplier. The power structure is supplier dominant (A>B). Supplier 3 is a sole supplier of the specialty coating material and resin for which Trespa has a custom recipe. Since the merger of the two suppliers Trespa has to rely on one and has been unable to move to dual sourcing. The purchased materials are complex, unique and their composition and production process is hard to replicate. This input is critical for Trespa, because it helps to achieve those product characteristics that give its competitive edge. Switching cost is high and the substitutability of the purchased goods is low. Our data from Supplier 3 is not complete, but it is clear that Trespa is not a substantial customer and switching costs between buyers are low. For the needs of the focal company, Supplier 3 is in a monopoly position.

Trespa in this relationship is in a Willing adoption position regarding the proposed VMI system. It would enjoy similar direct and indirect benefits as with other electronic integration cases, however the intention to adopt was reduced by the moderate costs of the system, which was tailored for the supplier's convenience and by the high risk of a possible loss of investment. The power structure is clearly supplier dominant that puts Trespa in a Willing position without additional leverage. Supplier 3 did not show interest in adopting the proposed IOS, because of the perceived costs and low perceived benefits. Its dominant position in the relationship enabled it to decide against the integration effort. The combination of the supplier's intention and power structure in this particular dyadic relationship makes it an Inhibiting partner.

According to the Adoption Position typology this is an Inhibiting-Willing relationship, which is a prohibitive structure. The proposition of a negative adoption decision in this case is confirmed.

SUPPLIER 3					
Int. to Adopt – Supplier 3		**LOW**	*Dependence on Trespa*		**LOW**
Perceived Benefits		**LOW**		Operational importance	Medium
	Direct Benefits	Low		Commercial importance	Low
	Indirect Benefits	NA		Substitutability of buyer	Medium
Perceived Switching Cost		**HIGH**			
	Infrastructure	Medium			
	Application	Medium			
	Business process	High			
	Specificity Inf.	NA			
	Specificity App.	High			
	Specificity BP.	NA			
Perceived Risk		**NA**			
TRESPA					
Int. to Adopt – Trespa		**MEDIUM**	*Dependence on Supplier 3*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	High		Imitability	Low
Perceived Switching Cost		**MEDIUM**		Substitutability	Low
	Infrastructure	Low			
	Application	Medium			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	Medium			
	Specificity BP.	Medium			
Perceived Risk		**HIGH**			
ADOPTION POSITION SUPPLIER 3 – TRESPA					
Power structure		**A>B**	Supplier dominance		
		Supplier 3	*Trespa*	Initiated by Trespa	
Intention to adopt		Low	Medium		
Power over partner		High	Low		
Adoption Position		**Inhibiting**	**Willing**		

Table 5-3: Summary of Case 3

5.1.10 Case 4: Supplier 4 – Trespa

Our last case from the supplier side of Trespa shows yet another IOS adoption and a variation of the underlying adoption positions. Supplier 4 is a small, family owned company in the Netherlands with 60 employees that specializes in impregnating paper with resin. Trespa can select from a large pool of suppliers (15 companies) to perform this task, which means that the switching costs of changing to another supplier are low. Supplier 4 impregnates 70% of the paper rolls of the manufacturer and was selected due to its reputation in the industry and the extent of its internal automation.

Not to jeopardize its own automated processes, Trespa decided to initiate an IOS project toward this SME. The small supplier did not have an ERP system, because it would not be economical to purchase such a software package for such a small company. Instead they had a legacy system, which was unable to send or receive XML-based messages. The integration required the focal company to do a special, relation specific mapping of the exchanged messages into a customized textfile format (CSV). This CSV file is then sent by email to the supplier. The supplier had to invest into a program a module that can read the file and upload the contents into its internal system.

The volume of transactions between Supplier 4 and Trespa is high and much more frequent than with other suppliers. This is a direct consequence of the nature of the service Supplier 4 is providing. Migrating these transactions to an electronic link, which is integrated with the companies' back-end system results in high direct benefits for Trespa. The cost of developing the CSV message mapping was moderate at best and risks were not perceived to affect the adoption decision. Although this solution was especially tailored to this supplier, the CSV mapping became is readily available to other partner firms and therefore relation specificity did not become an issue. The relatively small investment did not create post-adoption dependence on Supplier 4.

Supplier 4 expected both high direct and indirect benefits from the initiative and it was also motivated to comply the requirements of its customer due to the presence of competitive pressures. The costs of integration were medium-high for the supplier, but the benefits outweighed the costs. Trespa holds the largest share in the SME's revenue and therefore a very important customer. Trespa has a large pool of suppliers to select from for this particular service and it has low search and switching costs. Supplier 4 was selected based on its innovativeness and reputation. The dependence of Trespa on Supplier 4 scored much lower than the dependence of the supplier on the focal company. The power structure in this relationship is buyer dominant (A<B). This resulted in a Willing-Enabling adoption position pair, which is a supportive scenario.

Although Trespa was more powerful in this relationship, it tried to achieve co-adoption with a persuasive mindset. Trespa investigated and educated Supplier 4 about the possibilities of setting up an IOS and was willing to share the costs of investment by developing a specific message mapping. Supplier 4 expressed its intention to develop the system early in the project and there was no need for Trespa to use its leverage in a more coercive way.

SUPPLIER 4					
Int. to Adopt – Supplier 4		**HIGH**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	High		Substitutability of buyer	Low
Perceived Switching Cost		**MEDIUM**			
	Infrastructure	Low			
	Application	High			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Supplier 4*		**LOW**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	Medium		Imitability	Medium
Perceived Switching Cost		**MEDIUM**		Substitutability	High
	Infrastructure	Low			
	Application	Medium			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	Medium			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
ADOPTION POSITION SUPPLIER 4 – TRESPA					
Power structure		**A<B**	Buyer dominance		
		Supplier 4	*Trespa*	Initiated by Trespa	
Intention to adopt		High	High		
Power over partner		Low	High		
Adoption Position		**Willing**	**Enabling**		

Table 5-4: Summary of Case 4

5.1.11 The customer side of Trespa

Approximately 600 dealers and OEMs from all over the world make up the customer pool of Trespa. OEMs are mostly furniture manufacturers and use the panel as part of tables, cabinets, hospital beds. They are also called converters, because they cut up the

products to custom sizes. Dealers are wholesalers to the construction industry and are distributors for both internal and external applications. The product comes in standard sizes and colors, but can also be highly customized with differing dimensions and various printed surface patterns.

Compared to the supplier side of the focal company, electronic integration on the customer side is virtually non-existent. Our independent interviews with the Supply Chain Manager, Director of IT and Production, Order Processing Coordinator at Trespa provided a general outlook of the industry characteristics of the customers. After the general description we proceed to use the Adoption Position model to analyse numerous dyads on the customer side to explain the lack of IOS in these relationships.

The dealer network is part of the building industry that remained very traditional in its way of doing business. It consists of numerous SMEs whose main role in the supply chain is to accumulate stock and resell from stock. Trespa acquires projects by negotiating with construction companies and architects and they deliver the products through the dealer network. The dealers themselves are not highly automated and usually do not have much IT expertise in-house. Trespa distributes its products through the dealers continuously, but the regularity-, frequency- and the volume of transactions is low when it is projected down to individual dealers. These characteristics greatly contributed to their perception that using information systems to exchange data has low benefits, high costs and requires much time to learn.

OEM manufacturers in general are more advanced technologically and achieved a higher degree of automation relative to the dealers. The fact that they have many suppliers from various industries makes the emergence of a standard all the more difficult. OEMs are very conscious about adopting a system that could be used with a large pool of suppliers and have no interest in highly relation specific investments.

After our initial interviews it became clear that only Customer 1 had established an IOS connection with the focal company before Trespa initiated a large scale IOS project in 2004. All orders were sent by fax and had to be processed manually by Trespa. The Customer Order Processing team consists of 10 people who process the incoming orders manually, sometimes call the customer for clarification, send acknowledments and handle complaints. The high amount of manual labour involved rendered the order processing inefficient and prone to data errors.

To counter this, management at Trespa decided to launch a new IOS project aimed at the dealers and OEMs, similar to the one already present at the supplier side. The goal of the project was to get as many customers connected to their ERP business connector that would allow automatic order processing. Alternatively, customers would also have the option to send orders using a standard Excel file format or simple text file format, in case they did not run any ERP software capable of XML messaging. At this time we were already collecting data at Trespa when we were presented with the opportunity to send a survey to 32 customers together with the IOS proposal. This way we could gather data ex ante the adoption decision and we could follow some of the projects as they developed. The amount of collected and useable data points were not sufficient to conduct statistical analysis, instead we used the survey as a screening method to find representative cases for those adoption position pairs that have not been covered before. Data for Case 7–10 was collected this way. We gathered data for Case 5 and 6 by visiting Customer 1 on several sites.

Our *response rate* for the survey was 71% (23 companies out of 32), usable surveys were 18 out of 23, which eventually reduced the usable responses to 56% (18 out of 32). To achieve this relatively high response rate we designed the data collection in the following way:

- We sent our questionnaire to the selected sample of firms attached to the package of the IOS proposals under the Trespa logo. A cover letter explained the involvement of the academic research in the project. By being part of the integration project, the questionnaire was taken more seriously and was filled out by the majority of the firms.
- The letter assured the respondents that the data was only used for scientific purposes and anonymity was granted as requested.

Asking a company about its dependence on another company is a sensitive issue. A respondent might fake its answers to appear more positive in some cases in order to avoid a possible confrontation with its trading partner. To *remove this bias* we collected our data the following way

- Although the respondents received the questionnaire from Trespa, the reply envelope was addressed to the university. Respondents therefore could freely express their opinions about sensitive issues, such as dependence and perceived risks, because Trespa had no means of knowing their specific answers.
- The companies were assured that the data was only used for scientific purposes.

5.1.12 Case 5: Trespa – Customer 1

Customer 1 is a large distributor of wood products in the Netherlands. It does not only distribute, but stores and cuts the panels to custom shapes. In the supply chain of Trespa it takes a unique position by having both a dealer and OEM functions. It is one of the largest customers of the focal company with a long trading relationship.

Customer 1 has an internally built ERP system that was developed before SAP came to dominate the market. They established a standard EDI connection with Trespa in 1997. In fact this was the first IOS for the focal company and has remained the only one on the customer side ever since. Curiously it is the only EDI connection for Customer 1 on its own supplier side as well. Why was the electronic integration only established with Customer 1?

The adoption positions were Enabling-Enabling, while – as we will see later – other dyadic relationships are not so supportive. Customer 1 initiated the project, because it saw a lot of benefits in terms of cost reduction and lead time improvement with Trespa. Being the largest customer with the highest volume and with highly frequent (daily) and regular orders, the focal company estimated high positive benefits as well. Power analysis determined that both parties depend on each other due to the large trade volume and the unique qualities of the product, which are not easily substitutable and which enjoy a high demand from architects. This pilot project had a high cost for Trespa, because it had neither the previous experience nor the infrastructure to easily adopt the EDI connection. They used a Value-Added Network

(VAN) to provide the direct electronic link between the companies. At the time Trespa also perceived the project to be risky, because it was not sure that the EDI technology could be used with other trading partners or whether it will become obsolete in the near future.

Customer 1 incurred moderate costs from adopting the IOS. It already had an in-house implementation, but it still had to do a lot of data mapping. The large variety in product dimensions and surface properties generate more than 10.000 possible article numbers that had to be translated into their system. The IT infrastructure and business processes used in this IOS implementation were already established at the customer, however they had to do a great deal of specific work on the application integration level.

The high level of dependence on each other coupled with high perceived benefits from the project created an enabling relationship where both firm worked together to implement EDI.

TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Customer 1*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	Medium		Substitutability of buyer	Medium
Perceived Switching Cost		**MEDIUM**			
	Infrastructure	Medium			
	Application	Medium			
	Business process	High			
	Specificity Inf.	Medium			
	Specificity App.	Low			
	Specificity BP.	Medium			
Perceived Risk		**MEDIUM**			
CUSTOMER 1					
Int. to Adopt – Customer 1		**HIGH**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	Medium
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	Medium		Imitability	Medium
Perceived Switching Cost		**MEDIUM**		Substitutability	Low
	Infrastructure	Low			
	Application	High			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	Medium			
	Specificity BP.	Low			
Perceived Risk		**LOW**			

ADOPTION POSITION TRESPA – CUSTOMER 1			
Power structure	**A=B**	Interdependence	
	Trespa	*Customer 1*	Initiated by Customer 1
Intention to adopt	High	High	
Power over partner	High	High	
Adoption Position	**Enabling**	**Enabling**	

Table 5-5: Summary of Case 5

5.1.13 Case 6: Customer 1 – Tier 2 Customer

We have visited Customer 1 to find out why their company in particular started EDI among all the other customers. We have found out that they shared a centralized IT department (CICT – Central ICT) with a sister company that instead of the professional construction industry, serves the do-it-yourself (DIY) consumer market. The holding that owns both firms created an IT division and moved all information systems and data center there. Figure 5-3 gives an overview of the structure of this supply network.

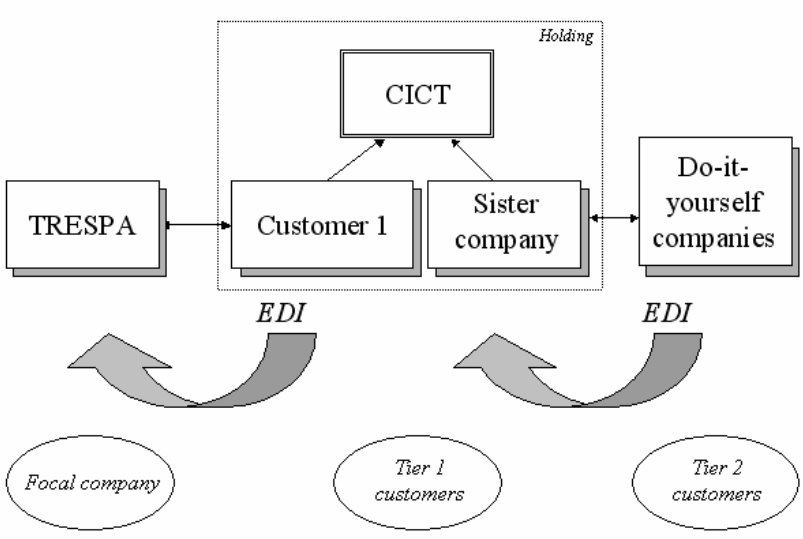

Figure 5-3: EDI diffusion in the supply network of Customer 1

We conducted interviews at Customer 1, the centralized IT division (CICT) and at the site of the Sister Company. The latter specialises in do-it-yourself products for applications in house construction and interior decorating and serves as a supplier for the DIY retailers, also referred to as Tier 2 Customers. A few large players in the Netherlands, such as Gamma, Praxis and Hornbach, dominate the DIY market. The Dutch DIY market is the fourth largest in Europe: total annual turnover in the Dutch DIY retail market was € 3.8 billion in 2001. There are approximately 4,390 DIY retail

outlets in the Netherlands. Of those, 584 are superstores (13 % of the outlets); they account for 61 % of the total turnover.

This market resembles the retail section of the grocery industry in many aspects: a low number of large companies operate in a highly competitive market with a large variety of products. Only three major holding companies own all major DIY superstores in the Netherlands. In terms of buying, the superstores tend to streamline the buying process and to cut the costs as much as possible. These companies pioneered in the use of IOS to achieve better operational efficiencies and just-in-time deliveries. The adoption and active use of EDI became a standard in the DIY market and a necessity for suppliers. The large DIY retailers mandated the use of EDI to their suppliers with the threat of switching business partners in case of non-compliance.

A further analysis of this situation revealed that there is a strong buyer dominant power structure between Tier 2 Customers (DIY retailers) and the Sister Company. There is a small, well-defined pool of customers for the Sister Company to sell its products to and losing any of these customers would mean the loss of a large portion of its revenue. Although it is a medium sized company with a large volume of transactions, it is clear that competition is high. The DIY retailers have a large pool of suppliers and the product offering of the Sister Company is not unique. Switching cost for the customer is low and their extensive network of retail sites makes them an important customer. They create reliable forecasts and therefore send regular, predictable purchase orders. Their innovativeness in the use of technology gives them a high reputation in the industry.

The DIY retailers started to implement EDI in the early 90s when it still required a significant investment from both parties. The Sister Company had low IT readiness and the required level of automation was not present in its processes. The management was put in a difficult situation where they had to invest in a new technology or else risking losing business. High competitive pressure forced the retailers to use their power to mandate the IOS adoption in a coercive way. Neither the benefits nor the costs of the system were equally shared, favouring the DIY retailers. This was clearly an Exposed-Enabling type of relationship regarding the EDI implementation and EDI was adopted under trading partner pressure. According to our model this Adoption Position pair results in the adoption of the proposed IOS. Case 6 corroborates this proposition.

The availability of EDI technology at CICT lowered further implementation costs for Customer 1 and triggered the EDI initiative toward Trespa. This spill over effect from the DIY market started the diffusion of EDI technology and the idea of efficient IOS-enabled sourcing in the supply network of Trespa.

SISTER COMPANY					
Int. to Adopt – Sister Co.		**LOW**	*Dependence on DIY*		**HIGH**
Perceived Benefits		**LOW**		Operational importance	High
	Direct Benefits	Medium		Commercial importance	High
	Indirect Benefits	Low		Substitutability of buyer	Low
Perceived Switching Cost		**HIGH**			
	Infrastructure	High			
	Application	High			
	Business process	Medium			
	Specificity Inf.	Medium			
	Specificity App.	Medium			
	Specificity BP.	Medium			
Perceived Risk		**MEDIUM**			
DIY RETAILER					
Int. to Adopt – DIY Retailer		**HIGH**	*Dependence on Sister Company*		**LOW**
Perceived Benefits		**HIGH**		Operational importance	Low
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	High		Imitability	Medium
Perceived Switching Cost		**MEDIUM**		Substitutability	High
	Infrastructure	Medium			
	Application	Medium			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
ADOPTION POSITION SISTER CO – DIY RETAILER					
Power structure		**A<B**	Buyer dominance		
		Sister Co.	*DIY*	Initiated by DIY retailer	
Intention to adopt		Low	High		
Power over partner		Low	High		
Adoption Position		**Exposed**	**Enabling**		

Table 5-6: Summary of Case 6

5.1.14 Case 7: Trespa – Customer 2

Customer 2 is a distributor and stockholder of a range of specialist sheet materials in the UK. For Trespa it provides a gateway to a niche market for its special product line, TopLab, which is not sold to many other dealers. Although Customer 2 provides just 4.4% of total revenues, this number becomes much more significant when we look only at the sales of the TopLab product line. The fact that Customer 2 provides a sales channel for the niche market in the UK makes it a very important trading partner. Customer 2 handles a wide range of competitive products rendering the focal company more easily substitutable.

Although Trespa panels are becoming more popular among architects, there are several other product lines in the distributor's assortment. In this case we found that Trespa's dependence on the buyer is higher then the dependence of Customer 2 on Trespa. The sources of power in this case are the small buyer pool for the specialist product line and the access to the UK market. When we only consider the TopLab product line the volume of sales to this buyer and the ordering frequency relative to the others is high. Trespa on the other hand has to face competition from other specialist suppliers for laboratory, washrooms and furniture products from all over Europe, which means the switching cost for the buyer is moderate and the revenues from Trespa products are not significant. The power structure in this dyadic relationship can be best described as buyer dominance (A<B).

Trespa approached Customer 2 with an IOS proposal, but its implementation was declined, because Customer 2 did not see any added benefits. Currently they are using their own gateway system that distributes purchase orders, which means that purchase orders are available electronically at the customer side. The system generates a fax message and sends it to Trespa. Customer 2 did not see any added benefits from changing its messaging standard to conform to Trespa's IOS proposal. The only benefit would be that order processing on the focal company's side would be faster and that an electronic order confirmation could be sent directly into the customer's system. To achieve this they would need to make specific investments to convert to the message standard proposed by Trespa. Customer 2 was unwilling to commit to the change and effectively declined the IOS proposal.

Trespa had all the intention to change its fax-based order processing to an integrated electronic solution, based on the reasons described in section 5.1.11. Combined with the buyer dominant power structure present in the relationship, Trespa had a Willing adoption position. Customer 2 exhibited no intention in the adopting the IOS initiated by Trespa and having more power in the dyad resulted in an Inhibiting position. The relationship was Willing-Inhibiting and the hypothesis for a negative adoption decision has been corroborated by this case.

TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Customer 2*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	High		Substitutability of buyer	Low
Perceived Switching Cost		**LOW**			
	Infrastructure	Low			
	Application	Medium			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Low			
Perceived Risk		**MEDIUM**			
CUSTOMER 2					
Int. to Adopt – Customer 2		**LOW**	*Dependence on Trespa*		**LOW**
Perceived Benefits		**LOW**		Operational importance	Low
	Direct Benefits	Low		Commercial importance	Medium
	Indirect Benefits	Medium		Imitability	Low
Perceived Switching Cost		**MEDIUM**		Substitutability	High
	Infrastructure	Low			
	Application	High			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
ADOPTION POSITION TRESPA – CUSTOMER 2					
Power structure		**A<B**	Buyer dominance		
		Trespa	*Customer 2*	Initiated by Trespa	
Intention to adopt		High	Low		
Power over partner		Low	High		
Adoption Position		**Willing**	**Inhibiting**		

Table 5-7: Summary of Case 7

5.1.15 Case 8: Trespa – Customer 3 (Customer initiative)

Customer 3 enabled us to analyse two IOS proposals, one initiated by the focal company, the other by the buyer. In terms of unit of analysis this means that each IOS proposal creates a unique case and therefore we discuss them separately. We chose to follow a chronological order, starting with the buyer initiated adoption decision. Case 9 thus features the same dyad, but with the Trespa initiated IOS proposal in focus.

Customer 3 is a small OEM manufacturer contributing to 0.08% of total sales. It produces a variety of office furniture, such as desks, chairs and drawers. Trespa panels are used for one of their product line for table-tops and side material for drawers. The unique properties and look of the panel gives this product line a luxurious, sturdy image, which proved to be very appealing in an office environment, according to the company.

Customer 3 is running an ERP system from BAAN together with a Purchasing module. In 2005 they have started developing the iQBS Webportal procurement portal. The portal manages purchasing orders and confirmations with the use of CSV text files. These text files have a proprietary format and are exchanged via email. Customer 3 sent the IOS proposal to hook up to the procurement portal to Trespa when it was already developing its plans for a large scale IOS implementation on its customer side. Trespa did not want to customize its system to this one customer, because it already had its own standard for CSV files. The small size and the relatively low volume of purchase order from this customer did not provide enough benefits to justify the costs and the necessary relation specific integration effort. This means that Trespa perceived low benefits regarding this project and a moderate switching cost in terms of highly relation specific application integration, which resulted in no actual intention to adopt the IOS proposed by the customer. Another reason for why Trespa did not want to adapt to the customer was that by doing so, they would make an exception among the buyers. Trespa feared that other customers who invested into the their standards would feel offended by having made such an exception, which would spoil their good working relation.

The customer showed higher dependence on Trespa, because the success of one of its product line depended on the focal company. The special sheets are critical components in these products and are not easily imitated or substituted. This put Trespa into an Inhibiting adoption position, while having no leverage, Customer 3 was a Willing company. In accordance to the propositions this IOS proposal was rejected.

TRESPA					
Int. to Adopt – Trespa		**LOW**	*Dependence on Customer 3*		**LOW**
Perceived Benefits		**LOW**		Operational importance	Medium
	Direct Benefits	Medium		Commercial importance	Low
	Indirect Benefits	Low		Substitutability of buyer	High
Perceived Switching Cost		**MEDIUM**			
	Infrastructure	Low			
	Application	Medium			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	Low			
Perceived Risk		**MEDIUM**			
CUSTOMER 3					
Int. to Adopt – Customer 3		**HIGH**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**HIGH**		Operational importance	High
	Direct Benefits	High		Commercial importance	Medium
	Indirect Benefits	High		Imitability	Low
Perceived Switching Cost		**MEDIUM**		Substitutability	Low
	Infrastructure	Low			
	Application	Medium			
	Business process	NA			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	NA			
Perceived Risk		**LOW**			
ADOPTION POSITION TRESPA – CUSTOMER 3					
Power structure		**A>B**	Supplier dominance		
		Trespa	*Customer 3*	Initiated by Customer 3	
Intention to adopt		Low	High		
Power over partner		High	Low		
Adoption Position		**Inhibiting**	**Willing**		

Table 5-8: Summary of Case 8

5.1.16 Case 9: Trespa – Customer 3 (Trespa initiative)

Case 9 features the same dyadic relationship between Trespa and Customer 3 as Case 8, but the IOS proposal is different. After having rejected the customer's IOS proposal, Trespa decided to include Customer 3 to the pool of buyers whom they selected to approach with their own initiative. Altogether 35 companies were selected from the dealer and OEM network to be involved in the first wave of electronic integration. The selection criteria were the importance of the buyer and its IT maturity or affinity to technology. Customer 3 exhibited competence regarding supply chain integration and was asked whether it was willing to adopt the message standards set by Trespa.

After some negotiations Customer 3 was willing to consider the proposal and adjust its own portal application to be able to receive and interpret the CSV file standard from the focal company. Both Trespa and the buyer organization wanted to achieve a sort of electronic integration, but because of the above stated reasons, Trespa did not want to make an exception with a rather small customer and abandon its own standards. Customer 3 was not very keen to adjust its own system specifically to this proprietary standard and perceived high costs with low benefits. Eventually Trespa offered its help in the implementation and persuaded the customer to adopt the system. Trespa's willingness to connect to Customer 3 and its significant power leverage put it in an Enabling adoption position. Customer 3 initially did not want to adjust its portal application, but was dependent on its supplier, making him Exposed. This created an Enabling-Exposed situation where power played a major role and that lead to the implementation of the IOS.

<table>
<tr><th colspan="5">TRESPA</th></tr>
<tr><td colspan="2">Int. to Adopt – Trespa</td><td>HIGH</td><td rowspan="4">Dependence on Customer 3</td><td>Operational importance</td><td>Medium</td></tr>
<tr><td rowspan="3">Perceived Benefits</td><td>HIGH</td><td>Commercial importance</td><td>Low</td></tr>
<tr><td>Direct Benefits</td><td>High</td><td>Substitutability of buyer</td><td>High</td></tr>
<tr><td>Indirect Benefits</td><td>Medium</td></tr>
<tr><td rowspan="7">Perceived Switching Cost</td><td>LOW</td><td colspan="3" rowspan="8"></td></tr>
<tr><td>Infrastructure</td><td>Low</td></tr>
<tr><td>Application</td><td>Low</td></tr>
<tr><td>Business process</td><td>Low</td></tr>
<tr><td>Specificity Inf.</td><td>Low</td></tr>
<tr><td>Specificity App.</td><td>Low</td></tr>
<tr><td>Specificity BP.</td><td>Low</td></tr>
<tr><td colspan="2">Perceived Risk</td><td>LOW</td></tr>
</table>

CUSTOMER 3					
Int. to Adopt – Customer 3		**LOW**	*Dependence on Trespa*		**HIGH**
Perceived Benefits		**MEDIUM**		Operational importance	High
	Direct Benefits	Medium		Commercial importance	Medium
	Indirect Benefits	Medium		Imitability	Low
Perceived Switching Cost		**HIGH**		Substitutability	Low
	Infrastructure	Low			
	Application	High			
	Business process	NA			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	NA			
Perceived Risk		**HIGH**			
ADOPTION POSITION TRESPA – CUSTOMER 3					
Power structure		**A>B**	Supplier dominance		
		Trespa	*Customer 3*	Initiated by Trespa	
Intention to adopt		High	Low		
Power over partner		High	Low		
Adoption Position		**Enabling**	**Exposed**		

Table 5-9: Summary of Case 9

5.1.17 Case 10: Trespa – Customer 4

The majority of the dealers remained reluctant to integrate electronically, despite the integration efforts of Trespa. Most of them keep the product as part of their assortment with no particular dedication or dependence to the focal company. Lot of them lack automation and the necessary investments in IT and in business process redesign discourages them to adopt an IOS.

Power structure in these cases is more of an independent nature (A0B) where a market situation exists with lot of buyers and suppliers. Neither the buyer nor the supplier possesses enough critical assets that would create a source of power. Supplier and buyer pools are large and products are easily substitutable. Although the imitability of Trespa products is limited due to its unique production process and the high quality of raw materials it is still in direct competition with other sheet material for interior- or any kind of façade fixtures for exterior applications. One example is Customer 4, a medium-sized distributor of construction materials in the Netherlands. Using our questionnaire they responded to the IOS proposal and expressed no particular interest in the adoption of any of the options. They expected low benefits due to the low volume and frequency of transactions with Trespa. The perception about investment costs was high mainly because of the lack of current IT systems that would support an IOS and lack of in-house IT knowledge. Customer 4 was also not sure whether the

proposed system could be used with other suppliers in the future and expressed concern about security issues.

TRESPA					
Int. to Adopt – Trespa		**HIGH**	*Dependence on Customer 4*		**LOW**
Perceived Benefits		**HIGH**		Operational importance	Medium
	Direct Benefits	High		Commercial importance	Low
	Indirect Benefits	Medium		Substitutability of buyer	High
Perceived Switching Cost		**LOW**			
	Infrastructure	Low			
	Application	Low			
	Business process	Low			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
CUSTOMER 4					
Int. to Adopt – Customer 4		**LOW**	*Dependence on Trespa*		**LOW**
Perceived Benefits		**LOW**		Operational importance	Medium
	Direct Benefits	Low		Commercial importance	Low
	Indirect Benefits	Low		Imitability	NA
Perceived Switching Cost		**HIGH**		Substitutability	High
	Infrastructure	High			
	Application	High			
	Business process	Medium			
	Specificity Inf.	NA			
	Specificity App.	NA			
	Specificity BP.	NA			
Perceived Risk		**HIGH**			

ADOPTION POSITION TRESPA – CUSTOMER 4			
Power structure	**A0B**	Independence	
	Trespa	*Customer 4*	Initiated by Trespa
Intention to adopt	High	Low	
Power over partner	Low	Low	
Adoption Position	**Willing**	**Exposed**	

Table 5-10: Summary of Case 10

With an independent power structure, Trespa acted as the Willing party in this dyadic relationship. Customer 4 had no intention to adopt the proposed IOS and had also no power over Trespa. The adoption positions of the companies in this case are Willing-Exposed. This is an unsupportive situation, which has been confirmed by the unsuccessful attempt to establish an IOS.

5.1.18 Summary of the cases at Trespa International

The Trespa case studies enabled us to the test a wide variety of scenarios. The company offered us a great opportunity to collect data from a large pool of cases, which showed very different characteristics and where we could observe both successful and unsuccessful IOS adoptions. The cases were used to establish the Adoption Positions of each firm in the dyadic relationship and to compare their actual adoption decision outcome with those of the corresponding propositions. These results support the research model without exception.

Figure 5-4 illustrates the supply network of Trespa depicting all the companies from Case 1 to 10. The lines connecting the companies represent the dyadic relationships and the outcome of the adoption decision. Solid lines show those dyadic relationships where the parties could achieve the co-adoption of an interorganizational system. Dotted lines represent a failed IOS proposal, where one of the parties did not agree to adopt a particular system. With the use of the Adoption Position pairs we can effectively map the supply network and the extent of electronic integration present within it.

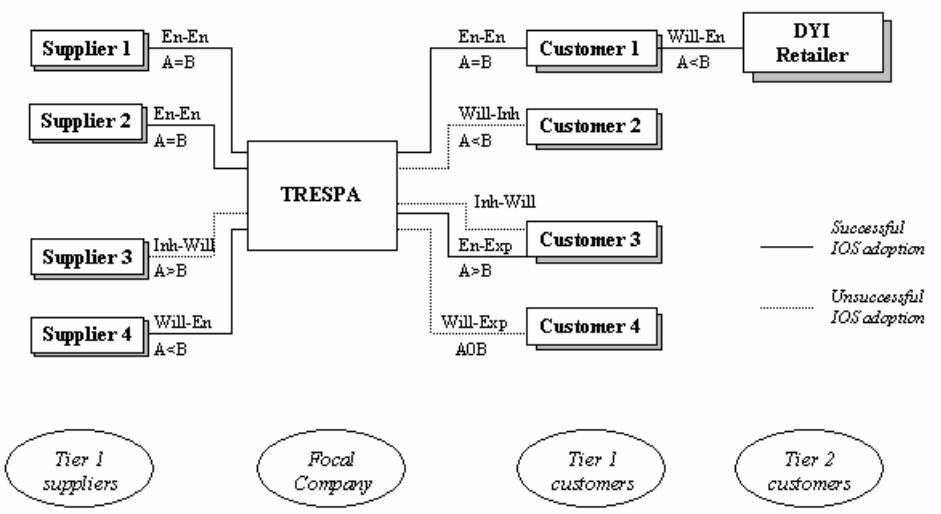

Figure 5-4: Adoption positions and power structures in the supply network of Trespa (Source: (Nagy, 2006))

5.2 BAKKERSLAND

This case study describes the relationship and the integration effort of two large Dutch companies in the food and grocery industry. The case is built up using the case study protocol in Appendix B. Bakkersland Tilburg was selected as the focal company and it gave us the opportunity to study one dyadic relationship. The large retailer, Albert Heijn, approached Bakkersland to improve its existing EDI link with new VMI functionality. The VMI system offered a lot of benefit for the retailer, but seemed to put only cost burden on the supplier. The reluctance of the supplier was overcome by the more powerful position of the buyer and system was implemented.

5.2.1 The industry

The Dutch Food Industry is one of the largest industrial sectors in The Netherlands and gives employment to approximately 120,000 people. More than 4 million consumers visit the 5100 supermarkets in the Netherlands daily. The turnover of Dutch supermarkets increased from €21.4 billion in 2000 to €22.9 billion, an increase of 6.6% (Jaarverslag - CBL, 2001).

There is an industry-wide coordinating body in the Netherlands called CBL (Dutch Bureau for Provision Trade) that is the umbrella organization for the Dutch supermarkets. CBL aims at increasing public knowledge about the provision trade and at reaching improved quality within the trade. In order to achieve these objectives, CBL carries out activities in many fields (food safety, production standards, product labelling and technology standards).

As the result of a unique joint effort of food traders (represented by the CBL) and the food industry (represented by the SMA: the Association of Branded Goods Manufacturers) in the Netherlands the EDI Service Center for the Food Sector was set up in 1997 to introduce EDI in the whole sector. The EDI Service Center (in Dutch: EDI Service Center Levensmiddelenbranche) is an independent, non-profit service provider, set up in response to demands from within the Dutch food sector. One of the main benefits of the activities of this organization is that the trade and industry use the same communication language (EANCOM) based on agreed guidelines. Although Bakkersland had established the EDI connection before 1997 it still uses the recommended EAN barcoding system; the CBL regulation had only an indirect effect on the firm through the influence of its main customer, Albert Heijn.

Other industry-wide (or EU) quality regulations are also in place (HACCP), the most important one is the regulation on meat products and their obligatory sourcing from a certified supplier to be able to track back possible diseases. These regulations however are not relevant for the current study.

5.2.2 The company

Bakkersland Easy Bakery is a large producer of bread and bakery products and also cake, deep-frozen and fastfood products in the Netherlands. It employs 2700 people and has a yearly turnover of 365 million euros. The market for bakery products consists of 6.8% of the total food industry. The company owns 26 plants in the Netherlands and has a sales organization in several European countries (Belgium, Germany, France, Spain and Italy) and it also exports to the US.

Before 1998, there had been 10 different family-owned companies competing on the market, until they decided to join their forces and formed Bakkersland. The company has ever since been growing through acquisitions both horizontally and vertically. The number of plants increased from 22 in 2000 to 26 in 2002 and there are plans for further expansion. Bakkersland also established its own retail stores and outlets nationwide (106 locations), the newest one being on Schipol Airport.

The wide range of products is grouped into four business units (BUs):

Daily fresh products: This BU gives the bulk of the goods; there are 16 bakeries operating under it with the principles of Just-in-time production. The market share of the BU is 40%.

Cooled-fresh products

Waffels: Bakkersland is the market leader in this segment, for instance it is the sole supplier of waffle to all the gas stations across the Netherlands.

Modified atmosphere packaging (MAP) products: Pre-baked breads, ciabattas, bread rolls, baguettes and croissants belong to this category. These products have an elongated expiration date due to the special gas that fills up the interior of the packaging. This BU is located in Tilburg (180 employees) and serves as the basis of this study. This BU has a 60% market share in its own product market.

Bakkersland has over 100 suppliers of raw materials, mainly from the Netherlands and from Belgium and a few others for packaging material from outside the Benelux. On the customer side, distribution creates an even more complex network not only because of the number of customers (appr. 60), but rather the existence of different distribution channels. Most of the products are shipped to distribution centers owned by the supermarket chains. There are 20 supermarket chains operating in the Netherlands and all of them have their own warehouses. Third-party logistics service providers carry out the transportation. Other distribution channels include independent warehouses, sales agents (across Europe and in the US), direct sales to restaurants and sales through company owned retail pastry stores and outlets. 85% of all the production goes to retail.

5.2.3 Internal IT

It is important to look at the internal organization of IT in the company to measure its readiness in terms of IT maturity and sophistication before an interorganizational integration effort.

Due to the fact that the merger of 10 different family businesses formed the company it has a very disparate IT heritage. It was soon evident for the owners that a system with such a decentralized nature is hard to maintain and data consolidation is a daunting task. This led to the decision that Bakkersland has outsourced all of its IT function to an Amsterdam-based company a few years ago. Currently the data center is run by an ASP (Multrex) that handles the software and Versatel maintains the network.

The outsourcing deal led to a certain extent of centralization, but the 26 different plants still run 26 different systems. Tilburg for example runs a Unix-based ERP package purchased from an American vendor. There are plans that a total consolidation will take place in 2007, when the company switches to a single ERP package. Parallel with this effort, due to the extensive use of ASP, the company wants to replace its desktop computers to terminals and all of its applications will be hosted at the central location.

Bakkersland still has an IT department at the headquarters, although there are only 6 people left who mainly provide technical support. These employees will specialize in different areas later on and will remain at the company.

These facts indicate a high level of IT sophistication and competence at the company and served a good basis for EDI adoption. However, quite surprisingly, the planning and scheduling in the MAP BU is still done by Excel spreadsheet software. Our interview with the managing director of this business unit indicated that having a clear IT strategy is very important for the company and the IT strategy is moderately aligned with the business strategy, this part remained a weak point of the internal system.

The use of Excel in planning and scheduling creates some difficulties in data handling, but the system can still measure up to the current requirements imposed by EDI. The company as a whole is planning to switch to a common ERP platform within 2 years, therefore the management does not want to invest into any additional IT project, which could become obsolete during the transition.

5.2.4 Integration with a major customer – Albert Heijn

Albert Heijn, a subsidiary of major international food retailer, Ahold, has over 650 stores throughout the Netherlands and a healthy 27% of the market share. It was the first retail chain in the industry that initiated the implementation of EDI with its suppliers. Its goals were consistent with that of CBL's; to establish EDI links with most of its suppliers by the year 2000.

Albert Heijn pushed the suppliers to adopt EDI through a value-added network. This action was not coercive, although the necessity of adoption became evident for late adopters. In the case of Bakkersland, Albert Heijn used supplier development practices to a certain extent by recommending the software and standard to use (industry-wide standard) and by demonstrating the benefits of EDI with presentations.

The management was persuaded that the new system would clearly have benefits for both parties. With the first wave of implementation the following standard EDI messages were developed (http://www.esc-lev.nl):

Purchase Order (ORDER)

Dispatch Advice (DESADV)

Receipt Acknowledgement (APERAK)

Invoice (INVOIC)

A middleware application translates the EDI messages to the language of the internal ERP system of Bakkersland. The volume of transactions for the bakeries in Tilburg is 18 messages per day, given that shipment is made every 24 hours to four distribution centers. After the implementation of the joint EDI link, Bakkersland used the same technology to connect to other customers. It seems that everyone accepts the industry-wide standard and companies do not have to deal with different message formats.

We can observe integration on other levels too, not only through IT investments. Business processes are harmonized so it takes only 85 hours from the receival of orders to the delivery of products to the shops. Packaging is highly customized and barcoding is used throughout the manufacturing process. The use of common logistical equipment and containers is practiced to such an extent throughout the industry, that all the crates and pallets are owned not by the members of the supply chain, but by the coordinating body, CBL. Albert Heijn and Bakkersland are using the same logistics service provider to avoid coordination problems with transportation. IT strategy formulation however is left mainly to the discretion of Bakkersland, only IOSs are coordinated.

5.2.5 A new wave of integration projects – the comakership policy (VMI)

Albert Heijn wanted to minimize its inventory level in the stores to near zero. In order to achieve this it wants to implement the classic case of vendor managed inventory (VMI) under the so called "comakership policy", where the supplier gains access to inventory levels and control over replenishment.

The new proposal wanted to add two more EDI messages next to the four existing ones: (1) inventory report and (2) delivery forecast. At the same time with the introduction of the new messages, the technology platform would have been shifted to WebEDI that uses XML-based messaging.

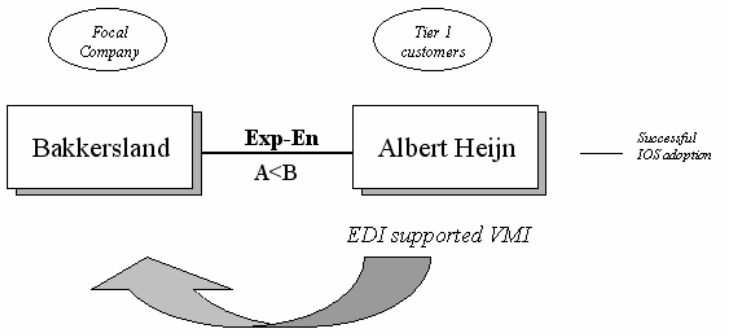

Figure 5-5: Adoption Positions of Case 11

5.2.6 Analysis of Case 11

Bakkersland was concerned about these new ideas. On one hand it was clear for the management that uncertainty caused by the seasonality of the products leads to the bullwhip effect. The demand for bakery products has seasonality properties. For example, December is a high season for the bakery, when inventory turnover can reach five times as much as it does on average. Also, retail chains sometimes forget to notify the bakery about an upcoming promotion and they place irrational orders when demand start to rise. Bakkersland have on average an inventory of one week, but sometimes this is drained in one day. A peak in sales in December usually followed by a drop in sales in January, when the stores try to sell the piled up inventory. Because of these reasons only 30% of the production is driven by an order, the remaining 70% is still being made to stock. In this sense, the new system would help streamline the process.

On the other hand the director was quite satisfied with the existing system in place and he thought that the current IOS could not be improved. He believed that the current degree of integration has already let them achieve a 99.4% service level toward the customer. Others in the management expressed their doubts whether such a process (VMI) is well suited for their ERP system and they feared that conflicts would arise. It was clear for Bakkersland that the implementation of VMI process would put additional burdens on their shoulders as a supplier (both in terms of costs and responsibility).

Bakkersland had low intention to implement the proposed IOS. It did not see substantial additional benefits from the new project and estimated high application integration and business process redesign costs, which was also quite specific to its relationship with Albert Heijn. The risk of investing into a technology that would need to be redesigned after the expected company-wide platform change also increased the resistance of the bakery. Albert Heijn was the initiator of the IOS and it saw high operational benefits from reduced inventory costs and increased level of product availability.

The power structure is buyer dominance. Bakkersland is more dependent on Albert Heijn, then the retailer on the bakery. Albert Heijn is the largest customer of Bakkersland, generating 25% of its total sales for its core business. The resource utility of the customer for Bakkersland as a sales channel and distribution network is very high. Substitutability of the retailer is moderate, since other retailers sell the same product line, but losing business with Albert Heijn is not an option for Bakkersland due to high opportunity costs.

The product itself is highly substitutable, there are other bakeries on this scale that provide the same product and which are directly competing for shelf space. The product is regarded as a commodity and is being sourced from several suppliers at once. Albert Heijn is clearly the dominant partner in this dyad and it took advantage of this position. Companies in the retail sector are under high competitive pressure and all aim to drive down operating costs while maintaining high service level for customers. Albert Heijn was determined to stick to its strategic goals that included the implementation of the VMI system. Despite the lack of intention, Bakkersland had to

implement the additional EDI messages and change its business processes. As the managing director of Bakkersland commented:

"Whatever Albert Heijn wants to do, we will have to follow eventually"

The adoption positions in the dyad were Exposed-Enabling. Our respective proposition predicts a positive adoption decision for this scenario, which was corroborated by Case 11. With the intent to closer integrate its suppliers, Albert Heijn initiated several activities on different organizational levels and through its more powerful position it managed to implement those. Although the benefits were perceived to be low by the management of Bakkersland, Albert Heijn used a persuasive approach when it exercised its power to gain the commitment from the supplier and to ensure a long-term relationship.

BAKKERSLAND					
Int. to Adopt – Bakkersland		**LOW**	*Dependence on AH*		**HIGH**
Perceived Benefits		**LOW**		Operational importance	High
	Direct Benefits	Low		Commercial importance	High
	Indirect Benefits	Low		Substitutability of buyer	Medium
Perceived Switching Cost		**HIGH**			
	Infrastructure	Low			
	Application	Medium			
	Business process	High			
	Specificity Inf.	Low			
	Specificity App.	High			
	Specificity BP.	High			
Perceived Risk		**HIGH**			
ALBERT HEIJN					
Int. to Adopt – Albert Heijn		**HIGH**	*Dependence on Bakkersland*		**LOW**
Perceived Benefits		**HIGH**		Operational importance	Low
	Direct Benefits	High		Commercial importance	Low
	Indirect Benefits	High		Imitability	Medium
Perceived Switching Cost		**MEDIUM**		Substitutability of supplier	High
	Infrastructure	Low			
	Application	Medium			
	Business process	Medium			
	Specificity Inf.	NA			
	Specificity App.	NA			
	Specificity BP.	NA			
Perceived Risk		**LOW**			

ADOPTION POSITION BAKKERSLAND – ALBERT HEIJN			
Power structure	**A<B** Buyer dominance		
	Bakkersl.	*AH*	Initiated by Albert Heijn
Intention to adopt	Low	High	
Power over partner	Low	High	
Adoption Position	**Exposed**	**Enabling**	

Table 5-11: Summary of Case 11

5.3 THE DUTCH INSURANCE INDUSTRY

In addition to the previous case studies, the Dutch insurance industry provided us the opportunity to observe four different adoption position scenarios. The case demonstrates that the research model is also applicable in the financial services sector and provides further support to the propositions.

5.3.1 Industry Structure

Insurance companies worldwide utilize four types of distribution channels to sell private line insurances: tied agent, banc assurance, direct insurance, independent agents. The absence of tight agents, who are under the payroll and ownership of insurance companies, makes the Dutch insurance market reliant on networks of independent agents and private sector economics. Independent agents are intermediaries who sell insurance policies of multiple insurance companies (also known as: carriers) to customers for a commission. These intermediaries help customers facilitate the search process by aggregating information from numerous carriers. This role diminishes information asymmetry for customers, who typically do not have perfect information on the available policies and would have to incur considerable search costs otherwise (Bailey and Bakos, 1997). A third player of the Dutch insurance market is the software vendor. These organizations develop and deliver Broker Management Systems (BMS) for independent agents.

According to official records of the Dutch Association for Insurers (Verbond van Verzekeraars) there are 512 insurance companies operating currently in the insurance market. Industry experts however estimate that approximately 50-100 insurance companies can be considered as real players, not counting the extremely small mutuals, which historically emerged from farmer communities. The 100 carrier organizations use a network of 6000 independent brokers as distributors of insurance policies. Most of the broker organizations are SMEs with only a few employees. There are approximately 200 brokers that employ more than 15 people, 100 with more than 100- and only 4 with more than a thousand employees.

In 2005, the total premium income for life insurances was €24.8 billion, for non-life insurances (vehicles, fire, liability, legal assistance, transport and travel) €11.2 billion

and for health insurances €11.3 billion with a total of €47.3 billion[1]. The market is very competitive and there is a lot of pressure on insurance companies. General insurance products have become a commodity and as such they yield low margins. In addition to the market competition, insurances sold by the banking sector through their own branch network poses an increasing threat to the competitiveness of the distribution channel of the carriers.

5.3.2 Early IOS Standard

In the early 80s a consortia of insurance companies decided that the industry needed to establish standard ways to work with the independent agent network. Independent agents worked with numerous carriers and the system would not have functioned had each insurance company defined their own business standards. The ADN (Assurantie Data Netwerk) was founded in the late 1980s and facilitated data communication between intermediaries and insurance firms and provided an industry-wide agreement about the message structures (Fairchild, 2006).

The ADN used a postbox model to facilitate the data exchange between agents and carriers. Messages for new policies, mutations, prolongations were sent by the broker to the mailbox of the particular insurance company. The insurance firms accessed their mailbox on a regular bases and downloaded the messages into their back-office system. This was an asynchronous, batch-oriented solution where each player operated independently from the other. An important disadvantage of this system is that independent agents did not possess the business logic to check the validity of the data and the data could only be checked for correctness after batch processing. The business logic provides information on the semantics and syntax of fields or combination of fields in a form. Once an error was discovered, the form was sent back to the broker for correction. This standard created a lot of delay and overhead in the process.

The ADN business standard had a negative commercial implication as well. It operated with fixed message standards and the addition of new attributes to the standard had to be approved by other members of the consortia. The incentive of the member firms was to delay any innovation initiated by the competitor. It soon became clear that fixed message standards discourage innovation and stop growth in the sector.

In the beginning of 1995 the message standards were replaced by more flexible models. This means that the message standards were still product oriented (e.g. car insurance), but companies could define and add attributes without consulting the others. The mailbox system was replaced by extranets that enable synchronous, near real-time communication. Each carrier maintains its own extranet, where brokers can log in and enter the data into the appropriate online form.

5.3.3 Current IOS Development

There were still problems with the industry standard. In 2000, network growth stopped, which could be attributed to the fact that standards were still not totally

[1] http://www.verzekeraars.org/smartsite.dws?id=43&mainpage=191&cat=english

objective and brokers still did not possess the business logic to validate their inputs. In 2001 the four largest insurance companies (Nationale Nederlanden, Delta Lloyd, Aegon and Fortis) decided that the old standards were obsolete and founded a standardization institute called SIVI[2] together with broker associations NVA and NVBA with the aim to create new industry standards. SIVI defines five major standards:

1. Process standard: The workflow of all the processes between carriers and agents are defined here. Message standards also switched to a process view from the old product-oriented definition. This means that the standards are now fully objective, because they create functional messages (e.g. new policy, change in policy), instead of standardizing the content for each product (car-, life insurance, etc).
2. All Finance Data Catalogue: Describes the semantics and syntax for the attributes and entities that are needed to facilitate the process between carriers and agents.
3. Presentation standard: Brokers do business with many insurance companies at the same time. Every insurance company has its own extranet for the brokers to enable electronic data exchange, the difference in the user interface for each extranet can delay the work of the agents. The presentation standard aims to standardize the user interface, the position of the fields on each form to decrease the learning cost of the agent and thereby making the distribution channel more efficient. Attributes are still customizable to the products of the carrier, however the same attributes will appear in a similar fashion across extranets.
4. General Information Manager (GIM): The GIM provides the technical specification of how the data is exchanged electronically. It is an XML- and SOAP-based IOS standard that describes how all the brokers could communicate with insurance companies. In our case, the GIM is the IOS that constitutes our unit of analysis.
5. Digital Passport: A security feature of the standard, certificates are issued to GIM compliant organizations.

The structure of GIM-enabled messages can take two forms: GIM with dialog or GIM without dialog. Dialog in this case means the interaction of the carrier's extranet server with the database of the BMS. Using the GIM protocol, the form is immediately checked for validity and using the dialog ensures that the correct data is entered to the system of the broker. Executing the GIM transaction without dialog is only feasible when there is very little business logic is involved in the transaction.

Both the carriers and the independent agents benefit from the use of GIM, but only at the cost of considerable investments (details are in the next section). At the time of this thesis only around 15% of the industry participants have implemented the GIM standard. The market is in a deadlock situation where brokers are waiting for insurance companies to equip more of their product with GIM capability and to add more functionality to the standard. At the same time, carriers are waiting for more

[2] Standaardisatie Instituut voor Verzekeringen in de Intermediairbranche (Standards Institute for Insurance in the Intermediary branch)

transactions using GIM to commit to the large investments for migrating their back-end systems. To achieve critical mass, the diffusion of the standard is pushed by both the broker associations and insurance companies in an individual, dyadic basis. This situation gives us the opportunity to analyse the adoption positions of the carriers and agents in light of the GIM standard.

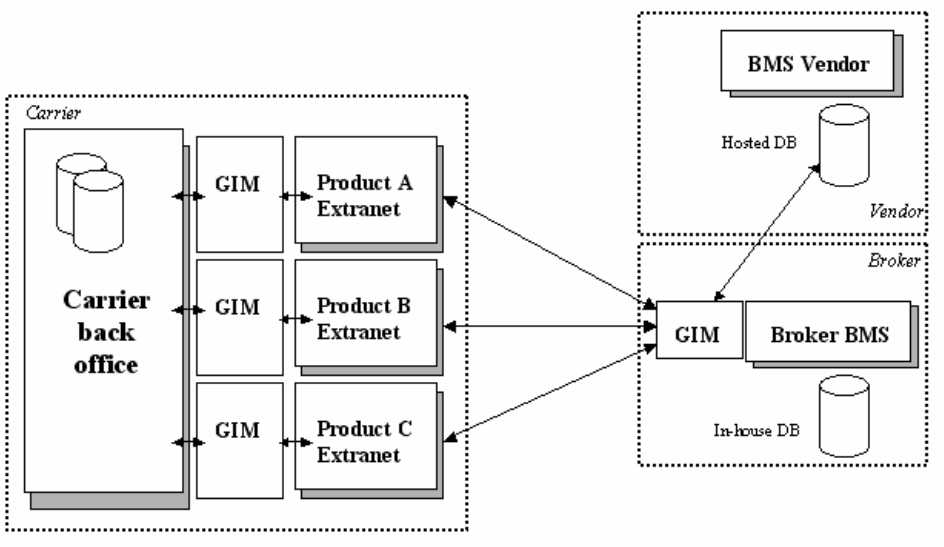

Figure 5-6: Extranet solution with GIM

5.3.4 Case Analysis

The banking sector poses a serious threat to the insurance companies. Banks, like ABN Amro and Rabobank, also sell insurance products in the Netherlands through their branch network. Banks have a direct control over the distribution channel and hence the cost structure. In the long run, banks are expected to lower their distribution costs via more optimized processes, which would enable them to lower the provision of the insurance products. Carriers need to keep their distribution channel equally competitive to prevent loss of market share. Since carriers work through a network of independent agents, they need closer channel integration in order to be able to drive costs down at the broker office.

Currently the most obvious way of driving operating costs down is to prevent the broker from having to manually enter policy related data twice into two different systems: the extranet of the carrier and its own BMS. GIM, the proposed IOS, is the first communication protocol that can integrate the extranets with the database of the broker and provide error checking at the same time. Rolling out such a standard for the whole intermediary branch requires a large investment and years of implementation. Industry experts estimate that currently there are three insurance companies that would be capable of rolling out an industry standard on this scale. Instead of working in isolation, the four largest insurance companies decided to work together on the project to share the costs and gain economies of scale from more widespread use of a single IOS standard. The group together have a total market share of 60%.

Carriers

At the time of the research the largest insurance companies have already adopted the GIM for most of their products. Implementation of the GIM standard necessitates an upgrade of the back office systems. This upgrade is a considerable investment and can take up to 3-4 years depending on the size of the carrier. We consider an insurance company an adopter, once it is committed to the investment and has started the migration to the new system.

Insurance companies have low direct benefits from the new IOS. The extranets have already been facilitating online transactions, where brokers can directly enter data into the carrier's system. Carriers benefit indirectly from the GIM on the strategic level. The GIM lowers the workload of the brokers by reducing the amount of manual data entry and allowing immediate error checking. Less work means less cost on the broker side that leads to a more competitive distribution channel for the insurance companies in the long run.

As we have already mentioned, insurance companies reported high implementation costs that stem from the need to upgrade legacy back-end systems that can handle web services and GIM dialogs. Databases and message structures need to be changed to become compliant with the new SIVI standards. Such an investment is not attractive for many carriers and many have trouble financing the IOS and the related internal IS projects. Unless there is a considerable portion of broker transactions that supports GIM, the short- term benefits are low and there is a perceived risk that the standard might fail and become obsolete.

Insurance companies depend on the overall network of independent agents, but because of the large pool of available brokers and the free competitive nature of the market there is no considerable dependence on a single broker firm. Switching costs are low, there are many brokers that cover the same geographic area, carry the same products and they offer similar services to customers. Even the largest insurance companies question their ability to force brokers to use the GIM, while the majority of carriers have no leverage on a broker at all. On a dyadic level the dependence of carriers (suppliers) on the brokers (buyers) is low.

Independent agents

Adopting the GIM would mean high direct benefits for broker organizations. In fact 85% of the operational benefits are on the broker side. The current workflow of processing policies requires the broker to enter the necessary data into the extranet of the insurance companies first, then enter the same data again into its own broker management system. The GIM integrates the two systems by automatically updating the BMS after a successful transaction, thereby saving time for the broker and reducing the amount of typing errors. Moreover, the validity of the data entered into the extranet is immediately checked by the business logic residing on the server. It is therefore ensured that the correct data is entered into the BMS that eliminates the chance of possible inconsistencies between the two databases. Small brokers with less understanding of the technology do not perceive high benefits as well as brokers with low volume of transactions.

The cost of implementing the GIM could be prohibitive for SMEs in the early stages. The GIM module itself is provided free of charge by the consortia of carriers (SIVI), which means that paying for the software is not an issue. Since GIM integrates with the broker's database, the BMS needs to be ready for the integration. Many brokers run legacy management systems that do not support web services. These brokers need to change their legacy architecture first. Some BMS software vendors operate with only a few thousand software licenses and have limited innovative capabilities to improve their software package. Other vendors usually charge extra fees for a GIM-enabled CRM module.

The second cost factor is the mapping of the GIM messages to the BMS database based on the All Finance Model. Interfacing to the broker system is again subject to the underlying architecture and the current database definitions. SMEs often do not possess enough technical knowledge to be able to carry out the changes and would incur additional consulting fees. Moreover, investments are only justified, when GIM could be used for most of the transactions. Currently, only a fraction of the carriers have adopted GIM and not all of their product lines support these transactions. The more transactions are supported by GIM on the carrier side, the higher the perceived benefits of the IOS for the broker. The perceived risk is similar to that of the carriers: if the GIM does not become a diffused IOS industry standard, the investment might become obsolete.

The power structure between brokers and carriers is independent. Generally, brokers offer policies from many carriers and one carrier contributes 5-10% on average of the broker's business. Large insurance companies, like Nationale-Nederlanden, Fortis, Aegon and Delta Lloyd do possess valuable resources for independent agents that create a moderate dependency. Brand name and the competitiveness of the insurance products can make these carriers more important for brokers than others. Commercial arrangements, like commission discounts can create a lock-in effect.

Brokers do not possess power over insurance companies and most of them not interested in adopting the GIM at this moment, given the perceived costs, risks and benefits of the standard. This renders them Exposed according to our classification. There is a smaller number of broker organizations that are committed to the change already, those with intention to adopt have a Willing adoption position.

5.3.5 Case results

The use of GIM is an option for the brokers, they can still conduct more labour-intensive online transactions without GIM.

We can distinguish two different insurance companies using the adoption position typology: The ones that actively pursue the diffusion of the standard are Willing firms, while the ones that are yet to see the benefits are Exposed companies. The analysis of the insurance industry revealed that there are four types of adoption position relationships between carriers and brokers:

- *Willing-Willing*: These dyads are actively working on GIM implementations. Each party is willing to invest into the project to comply with the proposed standard. These companies are large enough to have the necessary budget to upgrade their back-office systems or they are already GIM-certified. Benefits and costs are clear for them and they are optimistic about the eventual future diffusion of the standard. These relationships lead to the adoption of the IOS.
- *Willing-Exposed*: These dyads have the potential to facilitate transactions using the GIM. It is the typical adoption position pair between a member of the SIVI consortia and an SME broker. The carrier is ready to make the move for GIM transactions, however the broker is waiting and unsure. Budgetary problems, lack of expertise and low perception of benefits characterize the brokers. The lack of power does not give enough leverage to the carrier to force the broker into using the system. These relationships did not lead to the adoption of the IOS.
- *Exposed-Willing*: Less then 40 dyads belong to this category, where the broker has already implemented GIM-compliant systems and is ready to work with GIM-enabled extranets. The carrier as the supplier however has not intention to adopt the system until more brokers do so. The lack of power does not give enough leverage to the broker to force the carrier into using the system. These relationships did not lead to the adoption of the IOS.
- *Exposed-Exposed*: Normally not a viable dyadic relationship, because the lack of intention from both parties means that there is no IOS proposal present in the dyad and as such the unit of analysis does not exist. In the Dutch insurance industry, these parties are exposed to the idea of the GIM, but none of them committed to adopt it. These relationships did not lead to the adoption of the IOS.

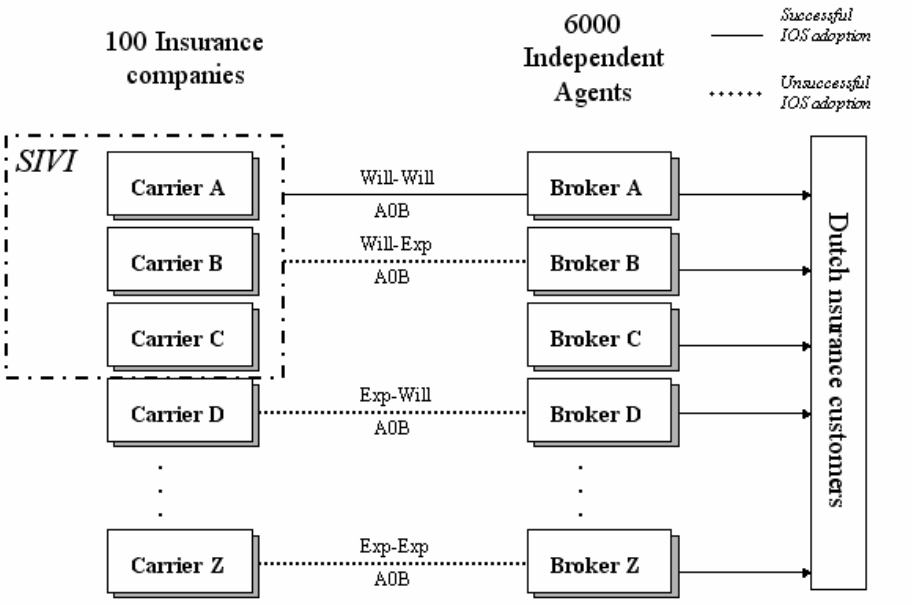

Figure 5-7: Adoption positions in the SC

The presence of these four types of adoption positions created a deadlock situation in the Dutch insurance market. The number of Willing-Willing relationships bound the extent of diffusion of the standard. In order for the GIM to become the accepted industry communication standard, additional measures need to be introduced. SIVI is cooperating with the broker associations, which in turn try to disseminate information among the brokers, increase awareness and educate their members of the long-term benefits of the new system. At the same time, Willing carriers are busy implementing the GIM for all of their product lines to increase the volume of GIM-ready messages, thereby stimulating more interest from brokers. These insurance companies are also educating Exposed brokers on a one-on-one basis to steer their perceived benefits higher and eventually converting them into a Willing adoption position. There are discussions about the extent to which insurance companies could help broker organizations financially in mapping GIM messages to the databases that would lower the cost for agents.

CARRIER A					
Int. to Adopt – Carrier A		**HIGH**	*Dependence on Broker B*		**LOW**
Perceived Benefits		**HIGH**		Operational importance	Low
	Direct Benefits	Medium		Commercial importance	High
	Indirect Benefits	High		Substitutability of buyer	High
Perceived Switching Cost		**HIGH**			
	Infrastructure	High			
	Application	High			
	Business process	Medium			
	Specificity Inf.	Low			
	Specificity App.	Low			
	Specificity BP.	Low			
Perceived Risk		**LOW**			
BROKER B					
Int. to Adopt – Broker B		**LOW**	*Dependence on Carrier A*		**LOW**
Perceived Benefits		**MEDIUM**		Operational importance	Low
	Direct Benefits	High		Commercial importance	High
	Indirect Benefits	Low		Imitability	Medium
Perceived Switching Cost		**HIGH**		Substitutability of supplier	Low
	Infrastructure	High			
	Application	High			
	Business process	High			
	Specificity Inf.	Low			
	Specificity App.	Medium			
	Specificity BP.	Medium			
Perceived Risk		**MEDIUM**			

ADOPTION POSITION CARRIER A – BROKER B			
Power structure	**A0B**	Independence	
	Carrier A	*Broker B*	Initiated by Carrier A
Intention to adopt	High	Low	
Power over partner	Low	Low	
Adoption Position	**Will**	**Exp**	

Table 5-12: Summary of Case 13

5.4 SUMMARY OF THE RESULTS

The results of the case studies support the research model and its propositions Table 5-13 provides a summary of all the cases. Cases are grouped by focal company, which is the firm that takes part in several of the observed dyadic relationships. The result for the four main constructs is listed along with the resulting adoption position pairs. The last two columns compare the predicted IOS co-adoption outcome with the observed IOS co-adoption decision.

Case No.	Dyadic Relationship	Supplier's intention to adopt	Buyer's intention to adopt	Dependence of supplier on buyer	Dependence of buyer on supplier	Adoption Position	Proposition	Result of adoption
Trespa International								
1	Supplier 1	Yes	Yes	High	High	**En-En**	+	+
2	Supplier 2	Yes	Yes	High	Medium	**En-En**	+	+
3	Supplier 3	No	Yes	Low	High	**Inh-Will**	–	–
4	Supplier 4	Yes	Yes	High	Low	**Will-En**	+	+
5	Customer 1	Yes	Yes	High	Medium	**En-En**	+	+
6	Customer 1 – tier 2 Customer	Yes	Yes	High	Low	**Will-En**	+	+
7	Customer 2	Yes	No	Medium	Low	**Will-Inh**	–	–
8	Customer 3 Trespa Initiative	Yes	No	Low	Medium	**En-Exp**	+	+
9	Customer 3 Cust. initiative	No	Yes	Low	Medium	**Inh-Will**	–	–
10	Customer 4	Yes	No	Medium	Low	**Will-Exp**	?	–
Bakkersland BV								
11	Customer Albert Heijn	Yes	No	High	Low	**Exp-En**	+	+
Dutch Insurance Industry								
12	Carrier A – Broker A	Yes	Yes	Low	Low	**Will-Will**	+	+
13	Carrier A – Broker B	Yes	No	Low	Low	**Will-Exp**	?	–
14	Carrier B – Broker A	No	Yes	Low	Low	**Exp-Will**	?	–
15	Carrier B – Broker B	No	No	Low	Low	**Exp-Exp**	–	–

Table 5-13: Summary of all case studies

		Buyer's adoption position			
		Enabling	**Willing**	**Inhibiting**	**Exposed**
Supplier's adoption position	**Enabling**	+	+	+/-	+
	Willing	+	+	–	–
	Inhibiting	+/-	–	–	–
	Exposed	+	–	–	–

Table 5-14: Observed adoption position pairs and tested propositions

These 15 cases were selected from a larger number of potential case studies, using the screening criteria explained in section 2.2.5. One of the criteria was to get as many representative cases as possible in order to be able to test the propositions. Although the observed cases could not cover all the possible adoption position pairs, we managed to collect data on 10 out of 16 combinations. The observed and tested propositions are highlighted with grey coloring in Table 5-14.

5.4.1 Research question 1

The collected data of the case studies and their analyses helps us answering the research questions. The first research question of this study is:

Q1*. What determines IOS adoption and non-adoption in supply networks in a meso level of analysis?*

This research shows that the adoption and non-adoption of an IOS proposal is not only a function of various factors, rather it is the function of a combination of factors. The two main constructs of Intention to Adopt and Power do not give adequate indication of an IOS decision by themselves. IOS adoption is not guaranteed when a company shows intention of adoption nor it is when a firm takes a dominant position in a supply network. Since the proper term to use in a situation when the success of a technology depends on the cooperation of multiple organizations is co-adoption, we need to involve the trading partner in the analysis. Factors measuring the intention and power level of a trading partner in a dyadic relationship are essential to determine the outcome of an IOS co-adoption.

Micro level factors are focusing on how an individual company reaches its own decision on Intention to Adopt. Internal politics, structure, strategy, presence of a champion and management commitment, etc., play an important role in this process, however they are not relevant for a meso level study. Similarly macro level effects, such as network effects, governmental regulations and industry-wide regulatory bodies are not measured directly.

On the meso level we have shown that the combination of focal company intention, focal company power, partner intention and partner power result in 16 possible scenarios of which only Inh-Inh, Inh-Exp, Exp-Inh are not realistic ones. We validated 10 out of the 16 scenarios, which means that different combinations of the above factors indeed yield different outcomes and that the variables of the research model and their relationships hold.

5.4.2 Research question 2

The second research question that we intend to answer with this study is:

Q2*: How does organizational power affect the adoption of IOS in supply networks?*

In our literature review we assessed that organizational power always manifested itself as a coercive pressure to alter the behaviour of the trading partner and thereby it was declared as a factor contributing to IOS adoption. In this study we have shown that power can just as well contribute to non-adoption in a dyadic context in certain combination of factors. When a company exhibits no intention to adopt an IOS and it owns assets, which are critical or important resources for the partner organization, it can refuse to cooperate in the implementation of the IOS proposal. In this case, power

acts as an inhibitor. Similarly, when a company expresses intention to adopt an IOS and owns critical assets, it can leverage these resources to persuade or coerce its trading partner to adopt an IOS. The extent of its success in both cases is still subject to its own dependence on the partner organization.

Intention to adopt signals what an organization wants to do, while its relative dependence shows what it can do. We need to measure both constructs to be able to derive a meaningful explanation or prediction to an adoption situation. The role of power also depends on who the initiator is. When a firm is in a Willing position and it initiates the IOS, power can act as an inhibitor, if the dyadic partner has no intention (Inh-Will, Will-Inh). If the same partner decides to implement the electronic link, it becomes an Enabler (En-Will, Will-En). In the latter case power did not play a role, since the initiator was the Willing firm, who has no leverage.

It is important to note that not having power is also considered a power-state and results in a power structure. When none of the parties depend on each other, an independent power structure is formed, which some would not call a power structure, since power is not involved. Low or high dependence however are both important power-states and should be considered during an IOS adoption analysis.

5.4.3 Summary of the chapter

We have applied the Adoption Position research model to 15 real life case studies in order to test the propositions. The analysis of numerous dyadic relationships from three different industries validated the research model and most of the propositions. We used the result of the analysis to answer the research questions. The next chapter continues the discussion on the implications of the results and how these results contribute to our comments on the literature offered in section 3.5

Chapter 6

Discussion and Conclusion

In the following pages we are going to discuss the results of the case studies and the research model in general. The section also offers a discussion on the contributions to theory and the implications to business practices of this study. Later we list the limitations of the study and provide directions for future research. Conclusions are drawn from the research and presented at the end of the chapter.

6.1 SUMMARY OF THE RESEARCH

The development of the research model was inspired by an identified gap in the IS adoption literature. Chapter 3 gave a detailed account of the relevant literature and the current state of related fields. After a careful analysis we have concluded that despite the rich knowledge base accumulated over the past decades, the information systems adoption field still has some shortcomings. The factors affecting adoption decisions of individual organizations are well established and the field seems mature enough to embrace a broader view on interorganizational relationships. The effect of a business partner on a company's decision to adopt a certain IOS cannot be neglected. The interorganizational nature of an IOS decision requires the careful consideration of the interest and motivation of all involved stakeholders, which are affected by social factors, such as power and trust. We have found that although the importance of behavioural factors has been widely mentioned throughout research studies about adoption and the diffusion of interorganizational standards, methodologically it has not been adequately handled. These issues are detailed in section 3.4.6.

After having identified these specific issues, a research plan was formulated to find the answers. Assisted by previous findings in the literature we developed a new model for IOS adoption that tries to remedy these shortcomings. Chapter 4 gave a detailed explanation of the model, its relation to other models in the field and its position regarding various philosophical stances and methodologies. We named the research model the Adoption Position model, because it posits the following: The successful co-adoption of any IOS that requires more than one party to agree on the standards and to make an investment in a supply network is a function of each party's intention to adopt the system *and* the underlying power structure in their respective interorganizational relationship. The intention of an organization to adopt an IOS coupled by its relative dependence on the trading partner puts it in one of the four possible positions: Enabling, Willing, Inhibiting or Exposed. The combined adoption positions of two trading partners determine the outcome of the decisions regarding co-adoption.

Propositions were developed and tested using multiple case studies. Chapter 2 offers a description of the research methodology used to conduct the study. The method of multiple case studies was chosen to collect data about various IOS adoption scenarios. The research design included several safeguards to ensure the validity and reliability throughout the entire process of data collection and data analysis. See section 2.2.5 for the details of case study research design. We sampled companies from several industries to check the generalisibility of the findings. The adoption position of each company was assessed in 15 IOS adoption cases and the outcome of the adoption decision was noted. The resulting relationship typologies and decisions were compared with the propositions. All multiple case studies are discussed in Chapter 5.

The case studies enabled the testing of a wide variety of scenarios. We have observed both adoption successes and failures and the results support the model without exception.

6.2 THEORETICAL IMPLICATIONS

This research contributes to the current body of knowledge in several ways. The first contribution comes from the integration of the concept of power structures into an adoption model. Power structures as we use them originate from the supply chain management literature and the synthesis of two theories provides us a new approach for studying and describing interorganizational information systems. This study does not only examine the technological perspective, but also socio-political, behavioural factors of the trading partners.

Studies about the adoption of information systems should include adoption failures under their scope. This way it becomes easier to identify the critical factors that distinguish a successful project from an unsuccessful one. Our cases suggest that the intention alone of a single organization to adopt is not a sufficient factor in the overall outcome of an adoption decision. We need to study the underlying power relations as well to get a better understanding of the phenomenon.

The model does not suggest that being in a more powerful situation in a dyadic relationship means a necessary exploitation or coercion of the dependent partner. Companies can use their power in a persuasive or a coercive way. This does not have an effect on our model as it only describes power relations and does not prescribe how the power is actually used or should be used.

The Adoption Position model builds on previous literature and covers many of the already validated constructs of the field. Particularly the intention to adopt construct is affected by a large number of variables. Compatibility of a legacy system with the new IOS (or readiness) is viewed here as the extent of investment needed in the current IS to accommodate the new system. Trust in the trading partner is again an important factor in IOS adoption and it is addressed in the perceived risk construct.

In section 3.4.6 we listed several comments on how the issue of power relations is handled in the IOS literature. We would like to reflect on those comments and discuss how the Adoption Position model attempts to overcome those shortcomings.

Detail of operationalization: The operationalization of the concept of power in the IOS adoption literature is often lacking detail. Power is a complex construct that cannot be viewed in absolute terms. Our dependence construct is based on the work of Emerson (1962) and Cox et al.(2002). The possession of valuable (utility) and scarce resources (substitutability) is creating critical assets for a company in a trading relationship. These critical assets establish the power base for firm A, because trading partners become dependent on firm A to gain access to those resources. In order to measure the presence of critical assets we used a synthesized list of power sources previously validated in the literature. This approach is much more detailed than having a single measure of power. It also enables the researcher and practitioners to probe into the reasons of dependence.

Consistency in operationalization: Our research in itself did not help achieve consistency in the operationalization, since we created another way to measure power. However, by using previous literature to give more detail to the operationalization of this construct we contributed to the research field by increasing the awareness of the use of more sophisticated measures through well-received publications. The diffusion of these ideas will hopefully help create more consistency in the operationalization of power.

Buyer-supplier distinction: As we previously noted, utility and scarcity measures are not the same for a buyer and supplier, meaning that they have a different view on the adoption decision with respect to their role. Therefore distinguishing between the buyer and supplier role in co-adoption studies is imperative. The Adoption Position model is very explicit regarding this issue. One of its basic assumptions is the presence of type II conflict (see section 3.4.1.2). We used an entirely different questionnaire to collect data from companies when they had played the role of a buyer or a supplier in a dyadic relationship. Power sources and critical assets are also different for each role.

Dyadic view: One of the main contributions of our research model is its dyadic view on adoption. Instead of looking at only one single company at a time we use an IOS proposition in a dyadic relationships for our unit of analysis. The main difference between IOS adoption and that of an internal information system is that decision on an IOS involves more than one organization. Joint decisions are needed on the number and the standard of messages to be exchanged and on the supported shared business processes. This necessitates the inclusion of trading partners in IOS studies. Next to economic factors such as perceived benefits and costs, behavioural concepts also become relevant, such as power and trust. It is important to note that power relations are relative and are specific to a trading relationship. Our cases support this where we saw that the same company can be very powerful in one relationship, but on the other hand can be very dependent in another. The dyadic view thus forms the core of our research model where the Adoption Position pairs are clearly relation-dependent.

Dominance oriented view on power: The model does not only consider power imbalance situations, but mutual dependencies as well. Power relationships are not categorised only to buyer- or supplier dominance, but we do consider interdependent and independent scenarios as well. IOS literature mostly cites buyer dominance situations when the role of power is mentioned. As we demonstrated using multiple case studies, mutual high or low dependencies do exist and can play an important role in the adoption of an IOS. Leaving behind a dominance oriented view on power is another important contribution of this study.

Unidirectional vs. Bidirectional view on power: The design of the model let us remove the widespread adoption bias. Non-adoption should not be viewed strictly as failure, it is rather a result of the combined strategic decisions of two trading partners. In a unidirectional view the relative power of a firm is used to reach adoption with the use of coercion or persuasion. Our cases support the idea that power can also act as a barrier towards adoption when the more powerful party does not have the intention to adopt. Therefore it is important to study the role of power both as a potential enabler and an inhibitor in IOS decisions. Current models of IOS adoption are unable to explain e.g. Case 3 and 8 and therefore miss out an important factor that explain dyadic IOR and the supply-network wide diffusion of IS. We advocate a bidirectional view on power in further IOS research.

Overreliance on the automotive industry: In our literature review we concluded that it could be the early cases from the automotive industry and their later citations that planted the adoption bias in the field. The automotive industry is characterised by extended networks of buyer dominance, adversarial relationships and has a history of coercive approach to EDI adoption. We try to overcome this by using case studies from numerous other industries in order to show the wide variety of adoption scenarios. We have shown many different power structures and adoption outcomes from the construction, paper, DIY, grocery and insurance industries. By doing so the results have become more generalisable.

6.3 PRACTICAL IMPLICATIONS

What strategies are available for an organization that wishes to introduce a new information system to exchange business documents, but has experienced difficulties in doing so? We can use the Adoption Position model to answer this question as well. Our propositions (Table 4-1) show those adoption position pairs, which are supportive for an IOS adoption decision. The company that wishes to implement a system with its trading partner therefore first has to evaluate the relationship and position of itself and of its partner. There are two ways to change the unfavorable position to a favorable one: either the focal firm has to persuade its trading partner into using the system or it has to increase its power level.

By increasing the benefits or lowering the barriers of adoption the focal firm can positively change the intention of its trading partner. Piderit (2000) found that lowering barriers is a more effective tool in influencing organizational behaviour.

Barriers such as switching costs of the partner (Nagy et al., 2004) incurred when switching to the new system can be lowered by using standardized applications that can integrate more easily into existing IT architecture or by jointly planning shared business processes, which will require less business process redesign (Nelson and Shaw, 2003).

The second strategic direction for an initiator of an IOS project is to increase its power base or to increase the dependence of the partner firm. This is much harder to achieve as it is often requires the redesign of the supply chain (vertical integration, disintermediation of intermediaries) or making significant changes in one's own business (higher value proposition for partner through increased commercial or operational importance (Cox et al., 2002) or by introducing new governance mechanisms (quasi integration and participation in joint decision making (Subramani and Venkatraman, 2003).

It is important to note that higher power that not necessarily means that it has to be used coercively. Power can be exercised in a persuasive way as well or merely the potential of having power can influence adoption (Hart and Saunders, 1997). Helping suppliers in developing the necessary capabilities to adapt to new business requirements (Krause et al., 1998) will establish trust in the relationship. This increased trust will lower the perceived risks of the IOS and create a positive intention towards adoption.

Thus a self-assessment of relative power of a firm will result in different negotiation strategies. A relatively more powerful firm might choose to coercively influence the behavior of its trading partner or could try to persuade it with a softer approach. A weaker firm could anticipate the requirements of a more powerful partner and employ a pro-active strategy (Webster, 1995). So far we assumed a single relationship between supply chain members, however these relationships are often multi-faceted (Wiseman, 1988). In such situations firm A might be dependent on firm B on one side, but could have the upper hand on another. Negotiation strategies become even more important in these cases. Multiple round adoption position analysis with varying negotiation strategies however are beyond the scope of the current research.

6.4 LIMITATIONS AND FUTURE RESEARCH

The findings of this study might be constrained by several limitations that can lead the direction of future research. Further research is needed to answer whether there are other factors that affect IOS adoption. The model is currently limited by design to meso level analysis, consciously excluding several factors. First, the study does not include micro level variables that deal with intra-company issues, such as internal politics, top management support, or the presence of a project champion. Therefore our dyadic view might limit our insight into the internal decision making process of the management.

Secondly, our model does not make reference to macro level variables, such as network externalities or regulatory power. We are aware that network effects are another factor that can have an effect on IOS adoption. Network effects in the form of peer pressure become increasingly important, as a particular IS standard diffuses among the majority of the nodes in the network. The increasing need to adopt this IOS

might manifest itself in the Perceived Benefits construct as companies realize that they will be able to use a particular standard with an increasing number of trading partners. Future research is necessary to establish this connection between perceived benefits and network externalities.

The model does not take into account other type of network effects, which are attributed to an industry-wide regulatory body or to governmental involvement. Case number 12-15 in the insurance industry suggests that these regulations become necessary when the Adoption Positions on the dyadic level are unsupportive for IOS adoption. In order to resolve these stalemate situations and to help improve the overall efficiency of supply networks, industry-wide standard bodies can mandate the use of certain IOS and shared process standards. The relation between the need for macro level pressures and unsupportive Adoption Positions could open up interesting research venues.

Third, the study is limited by its methodology. The research design requires the collection of data from both sides of a dyadic relationship, which increases data gathering with an order of magnitude. Response rate tend to be low when firms are approached to participate in case studies and even if they do, their trading partners are still need to be convinced. We employed various techniques to overcome this difficulty (questionnaire only without field study, questionnaires translated to language of the respondent, phone interview, cover letter expressing the support of focal company), still we lost several potentially interesting cases due to unwillingness of trading partners. Case selection was also limited geographically due to budgetary constraints.

Further research could test whether the propositions table (Table 4-1) is actually symmetric or not. An asymmetry would highlight interesting differences between the role of suppliers and buyers in the diffusion of IOS standards. The validated Adoption Position model could be used in future research to generate interesting hypotheses using the adoption position typologies, e.g.: Can a supplier in a Willing-Inhibiting adoption position change the relationship to a favorable one and if yes, how? What are the main reasons for being an Inhibitor? Do supply networks with favorable adoption positions perform better than ones, which are “broken” by an unfavorable adoption position pair?

The number of cases could limit the extent to which the results are generalizable. Further sampling from various industries might be necessary to strengthen the validity of the model. Data collection with the help of a questionnaire from a large pool of customers or suppliers of a selected focal company could enable a quantitative study that tests the propositions with statistical methods.

6.5 CONCLUSION

The cases suggest that the electronic exchange of information between trading partners does not only depend on their intention to adopt the system, but on the underlying power structure as well. A conflict of interest in IOS adoption coupled with an unsupportive power structure could lead to inefficiencies in the supply network and can indirectly thwart the efforts to realize an integrated supply chain. At the same time we have identified the type of relationships that are supportive towards collaboration. It is important for practitioners to recognize their own position in their relations with trading partners in order to formulate strategies on how to move from an unfavorable position to a favorable one.

With the help of multiple case studies we were able to validate our research model, because all of the cases supported the propositions without exception. Using the Adoption Position model we are able to explain why the co-adoption of IOS fails or succeeds. Our data so far corroborate the propositions, however more case studies from different industries and supply networks or other research methods could strengthen the validity of the research model.

By estimating the adoption position of both parties in a dyadic relationship one could predict the outcome of the adoption decision. This has important implications for both researchers and practitioners: Researchers are able to map entire supply chains and examine the prospect of supply chain-wide diffusion of a technology. Practitioners could benefit from the model by establishing a clearer view over their company's position in the supply network and to evaluate project proposals on different IOSs.

Appendix A

Glossary – Definition of Terms

Appendix A lists all abbreviated terms found in the thesis in alphabetical order.

ANSI.X12 –American National Standards Institute Accredited Standards Committee X12 (US National standards body for the development and maintenance of EDI standards for the United States)

ASN – Advance Shipment Notice

ASP – Application Service Provider

B2B – Business to Business

BC – Business Connector

DIY – Do-It-Yourself

EDI – Electronic Data Interchange

EDIFACT – EDI for Administration, Commerce and Transport

ERP – Enterprise Resource Planning

ICT – Information Communication Technology

IOR – Interorganizational Relationship

IOS – Interorganizational Information System

IS – Information System

POS – Point of Sale

OEM – Original Equipment Manufacturer

SC – Supply Chain

SCI – Supply Chain Integration

SCM – Supply Chain Management

TCT – Transaction Cost Theory

VAN – Value-Added Network

XML – Extensible Markup Language

Appendix B

Case Study Protocol

The case study protocol is an important tool that guides the researcher through the data collection process. It contains the instruments as well as the procedures and general rules to be followed by the investigator. Having the guidelines explicitly laid down does not only help the researcher in conducting multiple case studies in a similar fashion, but also increases the reliability of the findings. The protocol is essential for studies that intend to replicate the case study method used in this research.

Yin (2003) recommended the use of case-study protocol as part of a carefully designed research project that would include sections such as overview of the project, field procedures, specific questions to be asked and a guide for the report.

1) Case study questions to be addressed	We use case studies to collect data from real-life IOS adoption projects. The data is used to answer the following research questions: Why does IOS adoption fail or succeed in supply networks? How does organizational power affect the adoption of IOS in supply networks? The necessary data is determined by the Adoption Position model, which was developed for this study. Data is gathered for all variables specified in the model in order to validate the propositions. Each proposition predicts the outcome of the IOS adoption decision based on the i) the supplier's intention to adopt ii) the supplier's dependence on the buyer iii) the buyer's intention to adopt iv) the buyer's dependence on the supplier Additional data must be gathered about the focal company, such as the industry it operates in, market position, structure of the supply network, etc.
2) Setting up the case study	The unit of analysis is an IOS proposal in a dyadic exchange relationship. Only those cases suffice where i) an IOS is already in use (ex post adoption) ii) an IOS is planned and the adoption outcome can be later observed (ex ante) iii) the trading partner is also willing to provide input to the study Companies are sent an invitation letter or email to participate in the study. The letter briefly introduces the research topic, the type of questions the researcher is interested in, describes the potential benefits for the company and invites the respondent for an interview. A sample letter can be found in Appendix D.

3) Initial interview	The purpose of the initial interview is to gather background information from the company and to agree on the details of the data collection method. The interview takes place at the site of the respondent and takes appr. 1.5-2 hours (plus possible site tour). The respondent must be notified in advance to prepare with the following information: i) background information about the company, industry, market ii) detailed information about the product lines iii) detailed information about the purchasing, production and sales processes. iv) information about the current IT systems at the focal company v) a list of potential contact persons The initial interview can be followed by a tour around the site where the interviewer experiences the processes and the products. This interview is also used to ensure the readability of the questionnaire. The interviewer must have paper, pen at hand to make notes, must record the conversation (with the consent of the respondent) and must have a checklist reminder of the items discussed at this stage. The voice recording from the interview is transcribed to retain all information and to be readily available for further data collection and data analysis stages. The notes, drawings and copies of provided documentation must all be added in a structured way to the case database.
4) Follow up interviews and data collection	The purpose of follow-up interviews at the focal company are twofold: i) to collect data on the motives of the company, the relationships and critical resources with trading partners (repeat for each case the focal company is involved in) ii) to get different viewpoints on the same issues from various people at the firm or to access their different expertise. The various expertise and viewpoints come from: IT manager, Production manager, Procurement personnel, Sales manager or people with similar functions. Interviews start with open-ended questions and later enter in a structured stage with the use of the questionnaire. The respondent, while filling out the questionnaire, has the chance to ask questions or to clarify, detail his/her answers. The quantitative and the qualitative information collected this way helps to understand complex concepts, such as power relations. The questions for each variable are detailed in Appendix C, and there is a sample questionnaire in Appendix D.
5) Approaching dyadic partner	In this stage of the case study, trading partners of the focal firm are approached. The aim is to collect data from suppliers or buyers about their motives (not) to adopt an IOS and their power relation with the focal firm. Dyadic partners can be approached in the following ways: i) phone interview ii) mailed questionnaire with cover letter (see an example for cover letter to dyadic partner in Appendix D) iii) cover letter with a link to an Internet-based survey iv) field study. In this case the interviewer visits the dyadic partner and conducts interview. Revert back to number 3) and 4)

6) Data analysis	The case study database includes transcribes, interview notes, drawings, tabular data of surveys and copies of documents. Tabular data is analysed according to the methods listed in Appendix C. Qualitative data is used to set the context of each case and to find explanations to the various values of the constructs. Internal validity is ensured with the use of techniques such as pattern matching, rival explanations and building up the explanations. The purpose of the data analysis is to test the propositions with the collected data. The adoption positions of each case must be derived from the data together with the IOS adoption outcome. The resulting typology is then compared to the outcome predicted by the model.
7) Case write up	The goal of the write up is to report the results for both the academic community and the participants of the study. Key informants receive a draft case study report for review and approval before the results are published.

Appendix C

Constructs and Variables

In this appendix we are giving a detailed account on each construct used in the study. The constructs are operationalized to variables and the question items for each variable is listed. The purpose of this appendix is to show which questions items represent each variable in the questionnaire and how those answers were assessed.

Constructs in the conceptual model:

Construct	*Variables*
1000 Perceived Benefits	1100 Direct perceived benefits 1200 Indirect perceived benefits
2000 Perceived Switching Costs	2100 Compatibility / Readiness 2110 Perceived cost of changing IT infrastructure 2120 Perceived cost of application integration 2130 Perceived cost of changing business processes 2200 Relation specificity of change 2210 Specificity of IT infrastructure change 2220 Specificity of application integration 2230 Specificity of business process change 2300 Training
3000 Perceived Risks	
4000 Dependence on buyer	4100 Resource utility of the buyer for supplier 4200 Scarcity of buyer's resources
5000 Dependence on supplier	5100 Resource utility of the supplier for buyer 5200 Scarcity of supplier's resources 5210 Substitutability 5220 Imitability of supplied resource
6000 Intention to adopt	

Control variables:

7100	Firm size
7200	Job title of respondent
7300	Technology conversion type
7400	Role of the company in the supply chain
7500	Initiator of the IOS project
7600	Time of the survey (ex ante; ex post)
7700	Presence of a cartel

1000 Perceived Benefits

The variables:

1100 Direct perceived benefits
1200 Indirect perceived benefits

Operational description:
Perceived benefits are the anticipated advantages that the IOS can provide for the organization. The construct captures the perception of the decision makers, because the actual benefits of the proposed system are not known ex ante the adoption.

Value determination:
High, medium or low perceived benefits result from the average of direct perceived benefits (1100) and indirect perceived benefits (1200).

Reference:
Iacovou, C. L., Benbasat, I. and A.S., D. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly,* 19, 465-485.

Jones, M. C. and Beatty, R. C. (1998). Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models. *European Journal of Information Systems,* 7, 210-220.

1100 Direct Perceived Benefits

Indicators:

1110 Reduced transaction costs
1120 Improve cash flow
1130 Reduced inventory levels

Operational description:
Tangible items of perceived benefits. These benefits can be directly attributed to the introduction of the particular interorganizational information system.

Measurement method:
Please evaluate the following statements:
(Ex ante) In your opinion the use of the IOS will…
1110 …reduce transaction costs
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1120 …improve cash flow
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1130 …reduce inventory levels
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

(Ex post) Questions are in past tense.

Value determination:
The extent of direct benefits is determined as the average of the three items.

Formula:	1100 = (1110+1120+1130)/3
High	1100≥3.5
Medium	3.5>1100≥2
Low	2>1100

Reference:
Iacovou, C. L., Benbasat, I. and A.S., D. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly,* 19, 465-485.

Jones, M. C. and Beatty, R. C. (1998). Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models. *European Journal of Information Systems,* 7, 210-220.

1200 Indirect Perceived Benefits

Indicators:

1210 Improved information flow
1220 Improved internal operations
1230 Improved service
1240 Improved trading partner relations
1250 Improved competitive advantage
1260 Support strategic objectives

Operational description:
Intangible items of perceived benefits. These benefits are indirectly attributed to the introduction of the particular interorganizational information system.

Measurement method:
Please evaluate the following statements:
(Ex ante) In your opinion the use of the IOS will…
1210 …improve information flow
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1220 …improve internal operations
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1230 …enable us to provide better customer service
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1240 …improve trading partner relations
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1250 …improve competitive advantage
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

1260 …support strategic objectives
5-point Likert scale: 1 = strongly disagree, 5 = strongly agree

(Ex post) Questions are in past tense.

Value determination:
The extent of indirect benefits is determined as the average of the six items.

Formula:	1200 = (1210+1220+1230+1240+1250+1260)/6
High	1200 ≥ 3.5
Medium	3.5 > 1200 ≥ 2
Low	2 > 1200

Reference:
Iacovou, C. L., Benbasat, I. and A.S., D. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly,* 19, 465-485.

Jones, M. C. and Beatty, R. C. (1998). Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models. *European Journal of Information Systems,* 7, 210-220.

2000 Perceived Switching Costs

The variables:

2100 Compatibility/ Readiness
2200 Relation specificity of change
2300 Training

Operational description:
The anticipated costs of accommodating a new IOS into the current IT infrastructure and business processes. Most companies already have some sort of information system that enables data processing, data storage and intra/interorganizational communication. The implementation cost of a particular IOS depends on the current level of IT readiness and of the organisation and the compatibility of existing systems with the proposed one. High costs of switching to another platform or when the costs are highly relation specific can negatively affect the intention to adopt.

Value determination:
High, medium or low perceived switching costs result from the average of Compatibility / Readiness (2100), Relation specificity of change (2200) and Training (2300).

Formula:	2000 = (2100+2200+2300)/3
High	2000≥6
Medium	6>2000≥2
Low	2>2000

2100 Compatibility/ Readiness

Indicators:

2110 Perceived cost of changing IT infrastructure
2120 Perceived cost of application integration
2130 Perceived cost of changing business processes

Operational description:
Describes the IT maturity of the firm and the gap between the current and the required technological/operational level.

Value determination:
The extent of compatibility/readiness is determined as the average of the three items.

Formula:	2100 = (2110+2120+2130)/3

Reference:
Jones, M. C. and Beatty, R. C. (1998). Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models. *European Journal of Information Systems,* 7, 210-220.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly,* 28, 45-73.

2110 Perceived cost of changing IT infrastructure

Indicators:

2111 Site preparation
2112 Investments to IT infrastructure
2113 Compatibility to requirements

Operational description:
The extent to which the IT infrastructure necessary for the IOS is similar to the current infrastructure. The costs of necessary investment relative to the current state of IT infrastructure are perceptual values by the decision makers.

Measurement method:
Please evaluate the following statements:
(Ex ante) The adoption of IOS in our belief would…
2111 …require substantial site preparation
7-point Likert scale: 1 = Not at all, 7 = Very much

2112 …require substantial investments in our IT infrastructure
7-point Likert scale: 1 = Not at all, 7 = Very much

To what extent do you agree (or disagree) with the following statement(s):
2113 …Our IT infrastructure is totally compatible with the requirements of the proposed IOS and does not require additional investment
7-point Likert scale: 1 = Totally disagree, 4=Not sure, 7 = Totally agree

(Ex post) Questions are in past tense.

Value determination:
Inverse 2113

The extent of IT infrastructure costs is determined as the average of the three items.

Formula:	2110 = (2111+2112+2113)/3
High	2110≥6
Medium	6>2110≥2
Low	2>2110

2120 Perceived cost of application integration

Indicators:

2121 Application integration
2122 System modification
2123 Compatibility of applications

Operational description:
The extent to which the applications and configurations necessary for the IOS are similar to the current application portfolio.

Measurement method:
Please evaluate the following statements:
(Ex ante) The adoption of IOS in our belief would…
2121 …require substantial investment in application integration
7-point Likert scale: 1 = Not at all, 7 = Very much

2122 …require substantial modification of our computer system
7-point Likert scale: 1 = Not at all, 7 = Very much

To what extent do you agree (or disagree) with the following statement(s):
2123 …Our applications and information system are totally compatible with the requirements of the proposed IOS and does not require additional investment
7-point Likert scale: 1 = Totally disagree, 4=Not sure, 7 = Totally agree

(Ex post) Questions are in past tense.

Value determination:
Inverse 2123

The extent of application integration costs is determined as the average of the three items.

Formula:	2120 = (2121+2122+2123)/3
High	2120≥6
Medium	6>2120≥2
Low	2>2120

2130 Perceived cost of changing business processes

Indicators:

2131 Workplace
2132 Operating procedures
2133 Company operation
2134 Compatibility of business processes

Operational description:
The extent to which the current business processes are similar to the business processes necessary to accommodate the new IOS.

Measurement method:
Please evaluate the following statements:
(Ex ante) The adoption of IOS in our belief would…
2131 …disrupt the workplace
7-point Likert scale: 1 = Not at all, 7 = Very much

2132 …require changes in operating procedures
7-point Likert scale: 1 = Not at all, 7 = Very much

2133 …require substantial changes in the way our company operates
7-point Likert scale: 1 = Not at all, 7 = Very much

To what extent do you agree (or disagree) with the following statement(s):
2134 … Our business processes are totally compatible with the requirements of the proposed IOS and does not require additional investment
7-point Likert scale: 1 = Totally disagree, 4=Not sure, 7 = Totally agree

(Ex post) Questions are in past tense.

Value determination:
Inverse 2134

The extent of business process change costs is determined as the average of the four items.

Formula:	2130 = (2131+2132+2133+2134)/4
High	2130≥6
Medium	6>2130≥2
Low	2>2130

Reference:
Jones, M. C. and Beatty, R. C. (1998). Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models. *European Journal of Information Systems,* 7, 210-220.

2200 Relation specificity of change

Indicators:

2210 Specificity of IT infrastructure change
2220 Specificity of application integration
2230 Specificity of business process change
  2231 Administrative procedures
  2232 Operating procedures

Operational description:

The extent to which the investments made to accommodate the new IOS can be used with other trading partners. The more specific an IOS is to one trading partner the higher the investment cost is for that IOS relative to the number of trading partners. Low specificity means that the investment into the IOS can be used across many trading partners and the costs are spread out among more relationships. An investment with low specificity is more attractive and will have a positive effect on the intention to adopt.

Measurement method:

Please evaluate the following statements:
(Ex ante, buyer)

2210 The extent to which the physical IT infrastructure that would be used with <*name of trading partner*> are relatively similar or are significantly different from what you use with other suppliers.
  7-point Likert scale: 1 = Relatively similar, 7 = Significantly different

2220 The extent to which the software and applications used with <*name of trading partner*> are relatively similar or are significantly different from what you use with other suppliers.
  7-point Likert scale: 1 = Relatively similar, 7 = Significantly different

2231 The extent to which the administrative procedures used with <*name of trading partner*> are relatively similar or are significantly different from what you use with other suppliers.
  7-point Likert scale: 1 = Relatively similar, 7 = Significantly different

2232 The extent to which the operating procedures used with <*name of trading partner*> are relatively similar or are significantly different from what you use with other suppliers.
  7-point Likert scale: 1 = Relatively similar, 7 = Significantly different

(Ex post) Questions are in past tense.
(Supplier) Questions referring to suppliers are changed to buyers.

Value determination:

The extent of specificity of change is determined as the average of the four items.

Formula:	2200 = (2210+2220+2231+2232)/4
High	2200≥6
Medium	6>2200≥2
Low	2>2200

2300 Training

Indicators:

2310 Training of employees

Operational description:
The extent to which the company need to train its employees to the use of the new IOS.

Measurement method:
Please evaluate the following statements:
(Ex ante) The adoption of IOS in our belief would…
2310 …require substantial training for our employees
7-point Likert scale: 1 = Not at all, 7 = Very much

(Ex post) Questions are in past tense.

Value determination:
The extent of training costs is determined by one variable.

Formula:	2300 = 2310
High	2300≥6
Medium	6>2300≥2
Low	2>2300

3000 Perceived risks

Indicators:

3100 Information asymmetry risk
3200 Loss of resource control risk
3300 Post-contractual dependence
3400 Relation specific asset risk
3500 Relation specific process risk
3600 Risk of opportunism
3700 Technology risk
3800 Use of sub-optimal practices

Operational description:
The anticipated exposure to ex post hazards, uncertainties and opportunism after the adoption of the new IOS.

Measurement method:
7-point Likert scale: 1 = Not at all, 7 = Very much

Please evaluate the following statements:
(Ex ante) In adopting the IOS in our belief there is a risk that…
3100 …it would be hard to monitor the trading partner's compliance with the agreements
3200 …we lose control over some resources, know-how or information
3300 …our company is going to be more dependent on the trading partner
3400 …we cannot use the information system with other trading partners
3500 …we have to change our business processes in a way that would disrupt doing business with others
3600 … the trading partner will behave opportunistically
3700 …we invest in a technology that could become obsolete
3800 …we have to change our processes in a way that it is not optimal for us
(Ex post) Questions are in past tense.

Value determination:
The extent of perceived risks is determined as the average of the eight items.

Formula:	3000 = (3100+3200+3300+3400+3500+3600+3700+3800)/8
High	3000≥6
Medium	6>3000≥2
Low	2>3000

Reference:
Kumar, K. and Dissel, H. G. (1996). Sustainable Collaboration: managing conflict and cooperation in interorganizational systems. *MIS Quarterly,* 20, 279-300.

4000 Dependence on buyer

The variables:

4100 Resource utility of the buyer for supplier
4200 Scarcity of buyer's resources

Operational description:
The extent to which a buyer in a dyadic exchange relationship has power over a set of supplier(s). Power is the ability of a firm to own and control critical assets in markets and supply chains. Critical assets are supply chain resources that combine high utility with relative scarcity in a buyer-supplier exchange and in a market context. Dependence thus is a function of availability (relative scarcity) and motivational investment (utility).

Value determination:
High, medium or low dependence on the buyer is the result from the average of Resource Utility (4100) and Scarcity (4200).

Formula:	4000 = (4100 + 4200)/2
High	4000≥6
Medium	6>4000≥2
Low	2>4000

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

4100 Resource utility of the buyer for supplier

Indicators:

4110 Operational importance
4120 Commercial importance

Operational description:
The degree of operational and commercial importance of the supplied good or service for the supplier.

Value determination:
The following matrix determines the extent of resource utility.

Degree of commercial importance		Low	High
	High	Complementary Resource **Low – Medium** utility	Critical Resource **High** Utility
	Low	Residual Resource **Low** Utility	Key Resource **Medium – High** utility

Degree of operational importance

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

4110 Operational importance

Indicators:

4111 Weight of buyer
4112 Volume of product range
4113 Regularity
4114 Frequency of sales

Operational description:
The degree to which the buyer's expenditure to the supplier is indispensable and the degree to which the supplier can streamline its operations according to the demand pattern.

Measurement method:
Please answer the following questions

4111 Out of your total sales how many percentages go to your selected customer?
Numerical: Percentage (%)

4112 Out of your total sales in the focal product line, how many percentages go to your selected customer?
Numerical: Percentage (%)

4113 To what extent can you forecast the orders of your selected customer?
7-point Likert scale: 1 = Not at all, 7 = Very much

4114 How frequently does your selected customer order from you?
7-point Likert scale: 1 = Not at all frequently, 7 = Very frequently

Value determination:
The extent of operational importance is determined as follows.

Formula:	4110 = (4111/(100/7)+4112/(100/7)+4113+4113)/4
High	4110≥5
Medium	5>4110≥3
Low	3>4110

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

4120 Commercial importance

Indicators:

4121 Commercial importance

Operational description:
Whether the particular good or service is considered to be part of the primary or a support activity and what it contributes overall to the revenue and cost profile of the company.

Measurement method:
Please answer the following questions

4121 Does the traded good/service from the selected customer contribute to your organization's main business activities (where the most revenue comes from) or is it more like a support activity?
Dichotomous variable: Main business; Main, but niche; Support activity

Value determination:
The extent of commercial importance is determined as follows.

Formula:	Main business = 7 Main, but niche = 4 Support activity = 1
High	4120 = 7
Medium	4120 = 4
Low	4120 = 1

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

4200 Resource scarcity

Indicators:

4210 Buyer pool
4220 Supplier's switching cost
4230 Search cost
4240 Reputation of buyer

Operational description:
The extent to which the particular good or service is relatively difficult to source or it is difficult to substitute.

Measurement method:
Please answer the following questions

4210 How many customers could you sell the same product/service to?
Cardinal variable: Number of buyers

4220 How hard would it be to change to another customer to sell the same product?
7-point Likert scale: 1 = Not at all, 7 = Very much

4230 How hard is it to find another customer to sell your product to?
7-point Likert scale: 1 = Not at all, 7 = Very much

4240 Does the selected customer have a high reputation in the industry?
7-point Likert scale: 1 = Not at all, 7 = Very much

Value determination:
4210 is translated to a 7-point scale:

$4210 = 1 \rightarrow 4210 = 7$
$1 < 4210 \leq 5 \rightarrow 4210 = 6$
$5 < 4210 \leq 10 \rightarrow 4210 = 4$
$10 < 4210 \leq 50 \rightarrow 4210 = 2$
$50 < 4210 \rightarrow 4210 = 1$

The extent of resource scarcity is determined as follows.

Formula:	4200 = (4210+4220+4230+4240)/4
High	4200≥5
Medium	5>4200≥3
Low	3>4200

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5000 Dependence on supplier

The variables:

5100 Resource utility of the supplier for buyer
5200 Scarcity of supplier's resources
5300 Imitability of supplied resource

Operational description:
The extent to which a supplier in a dyadic exchange relationship has power over a set of buyer(s). Power is the ability of a firm to own and control critical assets in markets and supply chains. Critical assets are supply chain resources that combine high utility with relative scarcity in a buyer-supplier exchange and in a market context. Dependence thus is a function of availability (relative scarcity) and motivational investment (utility).

Value determination:
High, medium or low dependence on the supplier is the result from the average of Resource utility (5100), Resource scarcity (5200) and Resource imitability (5300).

Formula:	5000 = (5100 + 5200 + 5300)/3
High	5000 ≥ 6
Medium	6 > 5000 ≥ 3
Low	3 > 5000

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5100 Resource utility of the supplier for buyer

Indicators:

5110 Operational importance
5120 Commercial importance

Operational description:
The degree of operational and commercial importance of the supplied good or service for the buyer.

Value determination:
The following matrix determines the extent of resource utility.

Degree of commercial importance		Low	High
	High	Complementary Resource **Low – Medium** utility	Critical Resource **High** Utility
	Low	Residual Resource **Low** Utility	Key Resource **Medium – High** utility

Degree of operational importance

Reference:

Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5110 Operational importance

Indicators:

5111 Weight of supplier
5112 Indispensable resource

Operational description:
The degree to which a particular resource is indispensable to the provision of the firm's supply offering. It is determined by the volume of the buyer's spend in a particular resource relative to its total purchasing budget and the criticality of the procured product or service for the buyer's own product offering.

Measurement method:
Please answer the following questions

5111 Out of your total purchasing costs how many percentages go to your selected supplier? (%)
Numerical: Percentage (%)

5112 How critical the product/service offered by the supplier is for your organization?
7-point Likert scale: 1 = Not at all, 7 = Very much

Value determination:
The extent of operational importance is determined as follows.

Formula:	5110 = (5111/(100/7)+5112)/2
High	5110≥5
Medium	5>5110≥3
Low	3>5110

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5120 Commercial importance

Indicators:

5121 Commercial importance

Operational description:
Whether the particular good or service is used by the buyer in a primary or a support activity and what it contributes overall to the revenue and cost profile of the company.

Measurement method:
Please answer the following questions

5121 Does the traded good/service from the selected customer contribute to your organization's main business activities (where the most revenue comes from) or is it more like a support activity?
Dichotomous variable: Main business; Main, but niche; Support activity

Value determination:
The extent of commercial importance is determined as follows.

Formula:	Main business = 7 Main, but niche = 4 Support activity = 1
High	5120 = 7
Medium	5120 = 4
Low	5120 = 1

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5200 Resource scarcity

Indicators:

5210 Substitutability
5220 Imitability

Operational description:
The extent to which the particular good or service is relatively difficult to source or it is difficult to substitute. The buyer does not only have to option to find a substitute for a sourced product or a service, but also to imitate the sourced product or service. Therefore imitability is a differentiating variable from the resource scarcity of a supplier.

Value determination:
Low substitutability creates high scarcity.
Low imitability creates high scarcity.

The extent of resource scarcity is determined as follows.

Formula:	5200 = (5210+5220)/2
High	3>5200
Medium	5>5200≥3
Low	5200≥5

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5210 Substitutability

Indicators:

5211 Supplier pool
5212 Buyer's switching cost
5213 Search cost
5214 Reputation of supplier
5215 Innovativeness of supplier
5216 Differentiating value of product/service

Operational description:

The degree to which the particular good or service can be changed to another that provides the same or similar function. On one hand it is determined by the available alternative sources: the size of the potential supplier pool, search cost and switching cost. On the other hand, the reputation and the innovativeness of the supplier can differentiate the supply offering (or future offerings) and render the supplier less substitutable.

Measurement method:

Please answer the following questions

5211 How many suppliers could supply the same product/service that currently you buy from the selected supplier?
Cardinal variable: Number of buyers

5211b How hard would be to substitute the product of the selected supplier?
7-point Likert scale: 1 = Not at all, 7 = Very much

5212 How hard would it be to change to another supplier to purchase the same product?
7-point Likert scale: 1 = Not at all, 7 = Very much

5213 How hard it is to find another supplier who offers exactly the same product?
7-point Likert scale: 1 = Not at all, 7 = Very much

5213b We would have to invest much time and money in understanding the complexities of different supply offerings?
7-point Likert scale: 1 = Not at all, 7 = Very much

5214 Does the selected supplier have a high reputation in the industry?
7-point Likert scale: 1 = Not at all, 7 = Very much

5215 How innovative the selected supplier is?
7-point Likert scale: 1 = Not at all, 7 = Very much

5216 How much does the purchased product/service make your organization's offering different from others'?
7-point Likert scale: 1 = Not at all, 7 = Very much

Value determination:
5211 is translated to a 7-point scale:

5211 = 1 → 5211 = 7
1< 5211 ≤ 5 → 5211 = 6
5 < 5211 ≤ 10 → 5211 = 4
10 < 5211 ≤ 50 → 5211 = 2
50 < 5211 → 5211 = 1

Value determination:
The extent of substitutability is determined as follows.

Formula:	5210 = (5211+5111b+5212+5213+5213b+5214+5215+5216)/8
High	3>5210
Medium	5>5210≥3
Low	5210≥5

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

5220 Imitability

Indicators:

5221 Property rights
5222 Information impactedness
5223 Causal ambiguity

Operational description:
The degree to which the particular good or service can be copied. Imitation is another way to circumvent a particular scarce resource. It becomes harder to imitate, when it is hard to understand the production process of the product or the product itself due to its complexity. The extent to which imitation of a good or service is protected by licenses, patents and trademarks by the legal system also affects the imitability.

Measurement method:
Please answer the following questions
5221 Is the purchased protected by property rights?
Dichotomous variable: Yes/No

5222 How hard is it to understand that how the purchased product is made?
7-point Likert scale: 1 = Not at all, 7 = Very much

5223 How complex the purchased product is?
7-point Likert scale: 1 = Not at all, 7 = Very much

Value determination:
5221 = No → 5221 = 1
5221 = Yes → 5221 = 7

The extent of imitability is determined as follows.

Formula:	5220 = (5221+5222+5223)/3
High	3>5220
Medium	5>5220≥3
Low	5220≥5

Reference:
Cox, A., Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002). *Supply chains, markets and power: Mapping buyer and supplier power regimes,* Routledge, London.

6000 Intention to adopt

Indicators:

1000 Perceived Benefits
2000 Perceived Switching Costs
3000 Perceived Risks
6100 Control

Operational description:
The intention of an organization to implement an interorganizational information system after the assessment of its perceived benefits, costs and risks.

Measurement method – Control questions:
These questions were asked to control for the results from 1000, 2000, 3000.
6110 Do you think the company would benefit from adopting the IOS?
Dichotomous variable: Yes/No

6120 Are you interested in adopting the IOS in the company?
Dichotomous variable: Yes/No

6130 Do you think the benefits out weight the costs and risks of adoption of the IOS?
Dichotomous variable: Yes/No

Value determination:
1000 is translated to a 7-point scale:
1000 = 1000*(7/5)

Inverse 2000

Inverse 3000

The extent of intention to adopt is determined as follows.

Formula:	6000 = (1000+2000+3000)/3
High	6000≥5
Medium	5>6000≥3
Low	3>6000

Reference:
Iacovou, C. L., Benbasat, I. and A.S., D. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly,* 19, 465-485.

Control Variables

7100 Firm size
  7110 Yearly revenue
  7120 Number of employees
7200 Job title of respondent
7300 Technology conversion type
  7310 Presence of ERP
  7320 Type of electronic, interorganizational communication
7400 Role of the company in the supply chain
7500 Initiator of the IOS project
7600 Time of the survey (ex ante; ex post)
7700 Presence of a cartel

Operational description:
Control variables were included in the study to test whether variations in the results could be attributed to external factors. The following control variables are included: size of the firm, the respondent's job title, the type of IT platform available at the company at the time of the IOS proposal, the position of the firm in the supply chain, the initiator of the IOS proposal, whether it was an ex ante or ex post survey and if there is a cartel agreement present among competitors.

Measurement method – Control questions:
The measures are all multiple-choice questions.

7110 What is the approximate yearly revenue of your company?
Multiple choice: (1) Less than €500.000; (2) €500.000-€1 million (3); €1-5 million
(4) €5-10 million; (5) €10-50 million; (6) €50-200 million; (7) €200-500 million; (8) €500 - €1 billion; (9) More than €1 billion

7120 How many employees does your company approximately have?
Multiple choice: (1) 0-9; (2) 10-49; (3) 50-250; (4) 250-1000; (5) >1000;

7200 What is your function at your company?
Multiple choice: (1) Management / Owner; (2) Marketing / Sales; (3) Procurement (4) IT/Telecom; (5) Manufacturing; (6) Operations; (7) Other;

7310 Does your company have an ERP system?
Dichotomous variable: Yes/No

7320 What type of interorganizational system (IOS) is used at your company to connect with suppliers (buyers)?
Multiple choice: (1) Email; (2) Fax; (3) Online catalog with ordering (4) EDI; (5) XML-based EDI; (6) ERP module (SCM/CRM);

7400 What role does your firm play in the supply chain of your main activity?
Multiple choice: (1) Wholesaler; (2) Agent/Dealer; (3); Retailer
(4) Manufacturer; (5) Converter; (6) Storage intermediary; (7) Transportation intermediary; (8) Other;

7500 Who initiated the IOS project?
Multiple choice: (1) Our company; (2) Partner firm; (3) Industry-wide organization

7600 Who initiated the IOS project?
Multiple choice: (1) Ex ante; (2) Ex post;

7700 Do you think the selected supplier formed a cartel with other customers?
Dichotomous variable: Yes/No

Reference:

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly,* 28, 45-73.

Appendix D

Cover Letter and Questionnaire

The cover letter presented here was sent to the customers of Trespa International along with the IOS proposal and the questionnaire.

Dear <insert name of contact person>,

Trespa International is pleased to announce that it has started to work on a joint research project called 'Electronic Integration in the Supply Chain' together with Tilburg University, The Netherlands. Within the research project we would like to survey the intentions and motivations of our preferred customer base to join our 'Electronic Ordering Initiative'. As one of our preferred customer, we would like to invite you to participate in the study.

What does participation mean? We would like to ask you first to carefully read the document: Proposal for Electronic Integration, which you can also find in the envelope. This document describes the initiative that Trespa International would like to implement in the near future. The initiative aims to automate the order handling process, which is currently done manually between our companies. By replacing faxed orders with standardized electronic ordering messages, orders could be processed faster and we would be able to serve your company better.

After reading our proposal, we would like to ask you to fill out the attached questionnaire. The questionnaire itself does not require much time to complete (appr. 15-20 minutes), however it needs an in depth evaluation of the proposal.

This questionnaire is the result of the collaboration between Trespa International and Tilburg University and some questions are of academic interests only. The questionnaire will be sent back to Tilburg University instead of Trespa International for processing and the research team will keep the data confidential. Trespa International is going to receive a report on the findings instead of raw data, therefore assuring that information that you might find sensitive, but which is very important for the research, reaches only the academia.

After having completed the questionnaire, please place it in the reply envelope addressed to Tilburg University and send it back via mail. We are grateful for your collaboration and we are looking forward to work together on this project.

If you have any questions or comments about the proposal or the questionnaire, please contact us.

Regards,

Karen Pichal
Teamleader Order and Claims Processing Coordinator
Trespa International

Akos Nagy
Research Project

Tilburg University

Sample Questionnaire *(Buyer-ex ante)*

The following questions are specific to one of your supplier relations.
In this case we would like to ask questions about your relationship with
<Insert company name>.

Current IT systems in place

Does your company have an ERP system? ☐ Yes ☐ No

What type of interorganizational system (IOS) is used at your company to connect with suppliers?
(Please put an X to the appropriate cell)

IOS Type	**No such system is present**	**Our own system, developed by us**	**Partner's system, developed by partner**	**Packaged software from vendor**	**Do not know**
E-mail		X	X	X	
Fax		X	X	X	
On-line catalog with ordering					
EDI (Electronic Data Interchange)					
XML-based EDI					
SCM module of ERP system					

Explanation:

On-line catalog: Presence of a web-shop or product listing on the website of the supplier.

EDI – Electronic Data Interchange: An information technology that enables organizations to exchange business messages electronically in a standard form through a service provider company. Available standards are ANSI X.12 or EDIFACT

ERP – Enterprise Resource Planning system: Large, centralized information systems within an organization to integrate all functions and departments so that information can be accessed in every part of an organization.
For example: SAP, Peoplesoft, Oracle

IOS – Interorganizational information system: An information system that enables organizations to exchange business data electronically with other organizations, trading partners (e.g. orders, product catalogs, production schedules, inventory levels, payment).

SCM – Supply Chain Management: An optional module of an ERP system that enables tight integration with the suppliers of an organization.

XML – Extensible Markup Language: A flexible way to create standard information formats and share both the format and the data on the World Wide Web.

Perceived Benefits questions

To be able to answer the following questions we would like to ask you to read the attached Trespa Proposal for Electronic Integration. With this proposal in mind please evaluate the following statements by putting an 'X' into the appropriate square in each row.

In your opinion the use of the IOS will	*Strongly disagree*	*Disagree*	*Not sure*	*Agree*	*Strongly agree*
Reduce transaction costs	☐	☐	☐	☐	☐
Improve cash flow	☐	☐	☐	☐	☐
Reduce inventory levels	☐	☐	☐	☐	☐
Improve information quality	☐	☐	☐	☐	☐
Improve internal operations	☐	☐	☐	☐	☐
Enable us to provide better customer service	☐	☐	☐	☐	☐
Improve trading partner relationship	☐	☐	☐	☐	☐
Increase our ability to compete	☐	☐	☐	☐	☐
Reduce purchasing prices	☐	☐	☐	☐	☐
Improve access to supplier's price and product descriptions	☐	☐	☐	☐	☐
Support our strategic objectives	☐	☐	☐	☐	☐

Explanation:
IOS – Interorganizational information system: An information system that enables organizations to exchange business data electronically with other organizations, trading partners (e.g. orders, product catalogs, production schedules, inventory levels, payment).

Perceived Costs

The adoption of IOS in our belief would	To what extent do you agree with the following statements? Not at all						Very much
Require substantial site preparation	1	2	3	4	5	6	7
Require substantial investments in our IT infrastructure	1	2	3	4	5	6	7
Require substantial modification in our computer system	1	2	3	4	5	6	7
Require substantial investment in application integration	1	2	3	4	5	6	7
Disrupt the workplace, the way of working	1	2	3	4	5	6	7
Require changes in operating procedures	1	2	3	4	5	6	7
Require substantial changes in the way our company operates	1	2	3	4	5	6	7
Require substantial training for our employees	1	2	3	4	5	6	7

To what extent do you agree (or disagree) with the following statements:	Totally disagree=1			Not sure			Totally agree=7
Our IT infrastructure is totally compatible with the requirements of the proposed IOS and would not require additional investment	1	2	3	4	5	6	7
Our applications and information system are totally compatible with the requirements of the proposed IOS and would not require additional investment	1	2	3	4	5	6	7
Our business processes are totally compatible with the requirements of the proposed IOS and would not require additional investment	1	2	3	4	5	6	7

Specificity of IOS investments

	Relatively similar						Significantly different
The extent to which the **physical IT infrastructure** used with TRESPA are relatively similar or are significantly different from what you use with other suppliers.	1	2	3	4	5	6	7
The extent to which the **software and applications** used with TRESPA are relatively similar or are significantly different from what you use with other suppliers.	1	2	3	4	5	6	7
The extent to which the **administrative procedures** used with TRESPA are relatively similar or are significantly different from what you use with other suppliers.	1	2	3	4	5	6	7
The extent to which the **operating procedures** used with TRESPA are relatively similar or are significantly different from what you use with other suppliers.	1	2	3	4	5	6	7

Explanation:

IOS – Interorganizational information system: An information system that enables organizations to exchange business data electronically with other organizations, trading partners (e.g. orders, product catalogs, production schedules, inventory levels, payment).

To what extent do you agree (or disagree) with the following statement:	Totally disagree=1			Not sure			Totally agree=7
There are substantial risks in implementing the proposed IOS	1	2	3	4	5	6	7

Perceived Risks	To what extent do you expect the risk to be present?						
In adopting the IOS in our belief there is a risk that	Not at all						Very much
we cannot use the information system with other trading partners	1	2	3	4	5	6	7
we have to change our business processes in a way that would disrupt doing business with others	1	2	3	4	5	6	7
our company is going to be more dependent on the trading partner	1	2	3	4	5	6	7
we lose control over some resources, know-how or information	1	2	3	4	5	6	7
we invest in a technology that could become obsolete	1	2	3	4	5	6	7
it would be hard to monitor the trading partner's compliance with the agreements	1	2	3	4	5	6	7
we have to change our processes in a way that it is not optimal for us	1	2	3	4	5	6	7
the trading partner will behave opportunistically	1	2	3	4	5	6	7

Intention to adopt	**ERP Business connector**	**Standard CSV files**
Do you think the company would benefit from adopting the system?	☐ Yes ☐ No	☐ Yes ☐ No
Are you interested in adopting the IOS in the company?	☐ Yes ☐ No	☐ Yes ☐ No
Do you think the benefits out weight the costs and risks of adoption of the IOS?	☐ Yes ☐ No	☐ Yes ☐ No
What are your expectations about the ROI (Return on Investment) of the project?	_____%	_____%

Organizational Environment *(Please note that these questions are for academic interests only and the answers will be held confidential)*	
Out of your total purchasing costs how many percentages go to your selected supplier?	_____%
Does the traded good/service from the selected supplier contribute to your organization's main business activities (where the most revenue comes from) or is it more like a support activity?	☐ Main Business ☐ Main, but niche ☐ Support activity
How many suppliers could supply the same product/service that currently you buy from the selected supplier?	No. of suppliers: _____
Do you think the selected supplier formed a cartel with other suppliers?	☐ Yes ☐ No

	Not at all						Very much
How critical the product/service offered by the supplier is for your organization?	1	2	3	4	5	6	7
How hard it is to understand that how the purchased product is made?	1	2	3	4	5	6	7
How complex the purchased product is?	1	2	3	4	5	6	7
How hard it is to find another supplier who offers exactly the same product?	1	2	3	4	5	6	7
Does the selected supplier have a high reputation in the industry?	1	2	3	4	5	6	7
How innovative the selected supplier is?	1	2	3	4	5	6	7
To what extent do you think is there a threat of forward integration from the supplier (hostile takeover)?	1	2	3	4	5	6	7
To what extent do you think is there a threat that the supplier stops doing business with your organization, because it starts doing business directly with your customers?	1	2	3	4	5	6	7
How hard would it be to change to another supplier to purchase the same product?	1	2	3	4	5	6	7
54b How easily can you substitute the product of the selected supplier?	1	2	3	4	5	6	7
55. How much does the purchased product/service makes your organization's offering different from others'?	1	2	3	4	5	6	7

To what extent do you agree (or disagree) with the following statements:	Totally disagree=1			Not sure			Totally agree=7
We would have to invest much time and money in understanding the complexities of different supply offerings	1	2	3	4	5	6	7
We are very dependent on the selected supplier	1	2	3	4	5	6	7

Current Ordering Process

How many people are involved in ordering/procurement?

☐ 1 ☐ 3-5 ☐ >10
☐ 2-3 ☐ 5-10

Which function at your company does the ordering of products from Trespa?

☐ Procurement
☐ Planning&Scheduling
☐ Sales
☐ Finance
☐ Management/Owner
☐ Other:_____

Is the ordering process automated or manual?

☐ Automated
☐ Manual

What ways does the current ordering work?

☐ Phonecall
☐ Fax
☐ Mail order
☐ Email
☐ Electronic

Do you use electronic ordering with other suppliers?

(Please circle Yes or No as your answer)

Email	Yes / No
EDI	Yes / No
XML-based	Yes / No
Webcatalog	Yes / No
Electronic Markets	Yes / No
ERP Business con	Yes / No

To what extent is the need for our product predictable for you?

☐ Predictable
☐ Fairly predictable
☐ Difficult to predict
☐ Unpredictable

What policy does your company apply for ordering:

☐ Ordering for stock
☐ Ordering when there is a demand (customer order)
☐ Ordering on demand forecast

Do you prefer to give *(Please circle)*

Small	Medium	Large	**orders**
Frequent	Infrequent		**orders**

General Questions

What is the name of your company?_____

Which country is your company located in?

- ☐ The Netherlands
- ☐ Belgium
- ☐ UK
- ☐ Germany
- ☐ France
- ☐ Other:_____

What is your function at your company?

- ☐ Management / Owner
- ☐ Marketing / Sales
- ☐ Procurement
- ☐ IT/Telecom
- ☐ Manufacturing
- ☐ Operations
- ☐ Other:_____

What is the approximate yearly revenue of your company?

- ☐ Less than €500.000
- ☐ €500.000 – €1 million
- ☐ €1-5 million
- ☐ €5-10 million
- ☐ €10-50 million
- ☐ €50-200 million
- ☐ €200-500 million
- ☐ €500 - €1 billion
- ☐ More than €1 billion

How many employees does your company approximately have?

- ☐ 0-9
- ☐ 10-49
- ☐ 50-250
- ☐ 250-1000
- ☐ >1000

What role does your firm play in the supply chain of your main activity?

- ☐ Buyer in wholesale role
- ☐ Buyer in an agent role
- ☐ Buyer in retail role
- ☐ Manufacturing
- ☐ Converter
- ☐ Construction company
- ☐ Transportation intermediary
- ☐ Storage intermediary
- ☐ Other:_____

Are you willing to participate in a follow-up interview with us on the topic?

In case you are, please write down an e-mail address below, where we can contact you. *This e-mail address will not be used by us or by any other party for other purposes than this research inquiry. We do not solicit or disclose your e-mail address to other parties.*

Your email address: _____

THANK YOU!

You have finished the questionnaire, thank you for your time and effort!
Please put the completed questionnaire into the reply envelope and send it back to our research team at Tilburg University

Publications resulting from this thesis

Conference Proceedings:

Nagy, A. (2004) The effect of power on the adoption of interorganizational information systems: The adoption position model. In *Proceedings of the 12th European Conference on Information Systems (ECIS)* (Leino T., Saarinen, T and Klein, S, Eds), pp 1-8, Turku, Finland.

Nagy, A., Orriens, B. and Fairchild, A. (2004) The promise and reality of internet-based interorganizational systems. In *Proceedings of the International Association for Development of the Information Society (IADIS) International Conference e-Society* (Isaias P, Kommers P and McPherson M, Eds), pp 886-890, Avila, Spain.

Nagy, A. (2005) Difficulties in implementing the agile supply chain: Lessons learned from interorganizational information systems adoption. In *Business agility and information technology diffusion* (Baskerville RL, Mathiassen L, Pries-Heje and Degross JI, Eds), pp 157-171, Springer, Atlanta, Georgia, U.S.A.

Nagy, A. (2006) Collaboration and conflict in the electronic integration of supply networks. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS 39)*, Poipu, Kauai, Hawaii, U.S.A.

Book chapters:

Nagy, A. (2006) Collaboration and conflict in the electronic integration of supply networks. *Chapter 14 in Barnes, S. J. (2006) E-Commerce and V-Business*, *Butterworth-Heinemann, UK (upcoming)*

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SAMENVATTING

De integratie van leveranciers en afnemers ketens (supply chains) voor het faciliteren van tijdige en kwalitatief hoogwaardige informatie-uitwisseling tussen handelspartners is een essentiële component van supply chain performance. Electronic data interchange (EDI) en andere interorganisationele systemen (IOS) kunnen deze doelstellingen ondersteunen, maar de diffusie van dergelijke systemen in de keten is niet per definitie gegarandeerd. Zeer vaak faalt integratie door conflicterende belangen van de organisaties in de keten en door het ontbreken van algemeen geaccepteerde IT en proces standaarden.

In dit proefschrift wordt het Adoptie Positie theoretisch model ontwikkeld, en toegepast in vergelijkbare casussen om de oorzaken van het succes en falen van recente IOS adopties te onderzoeken. De analyse beslaat meerdere niveaus van drie internationale supply chains, en bevat 15 voorbeelden van 1:1 interorganisationele relaties.

De casussen suggereren dat de elektronische uitwisseling van informatie tussen handelspartners niet alleen afhankelijk is van hun intentie om het systeem te gebruiken, maar tevens van de onderliggende machtsstructuur. Een belangenconflict in IOS adoptie gekoppeld aan een negatief werkende machtsstructuur kan leiden tot inefficiëntie in de keten en kan indirect de pogingen om een geïntegreerde keten tot stand te brengen dwarsbomen.

De resultaten suggereren dat de intentie tot gebruik van een specifieke IOS en de relatieve machtsrelatie tussen de handelspartners tezamen de beslissing tot adoptie bepalen alsmede het niveau van samenwerking binnen de supply chain. Via het Adoptie Positie model hebben we de types relatie geïdentificeerd welke positief bijdragen aan samenwerking en welke niet.

Door een schatting te maken van de adoptie positie van beide partijen in een 1:1 interorganisationele relatie is het mogelijk het resultaat van de adoptie beslissing te voorspellen. Dit heeft belangrijke implicaties voor zowel onderzoekers als voor managers in de praktijk. Onderzoekers zijn in staat complete leveranciers en afnemers ketens in kaart te brengen en de vooruitzichten van de volledige diffusie van een integratie-technologie in de keten te bestuderen. Managers kunnen door middel van het model een helder overzicht verkrijgen inzake de positie van hun onderneming in de keten en deze kennis gebruiken bij de evaluatie van projectvoorstellen voor verschillende IOS. Het proefschrift bevat tevens suggesties voor strategieën voor het omzetten van een ongunstige uitgangspositie naar een gunstige teneinde IOS integratie tot een succes te maken.

Het proefschrift levert voorts een bijdrage aan de bestaande literatuur over IOS adoptie door het bevestigen van het belang van een bi-directioneel perspectief op macht. Onze casussen ondersteunen de notie dat macht ook kan fungeren als een barrière voor adoptie en dat non-adoptie niet altijd strikt als een falen dient te worden beschouwd, maar eerder als resultaat van het samenspel tussen de strategische beslissingen van twee handelspartners.